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July 1973

Mississippi Cotton Variety Test For 1972

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Bulletin 800

lississippi Cotton Variety Tests For 1972

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Mississippi Cotton Variety Tests For 1972

in the Delta

Testing of cotton varieties is needed in areas of cotton production to provide nformation on the relative merits of vaieties offered for sale. The cotton variety test results are useful guides to farmers in the selection of varieties posessing the best balance of productivity and fiber quality characteristics.

Cotton variety tests were conducted by the Delta Branch Experiment Station in 1972 at the Delta Station at Stoneville; Schaefer Plantation near Yazoo City; Mitchener Plantation near Sumner; and Arnold Farms near Tunica. Variety tests were conducted on wo test sites at Stoneville. One was on a Bosket very fine sandy loam, and another was on a Sharkey clay type soil.

Thirteen varieties were grown on hree of the test sites and two additional varieties were grown at Stoneville and Tunica. Varieties grown at Stoneville and Tunica are included in a cooperaive Belt-wide variety testing program. Five varieties were tested for the first ime at all locations. These were Deltapine 5916-65, Deltapine 652-679, McNair 511, Coker 5110, and Coker 5103.

Results are reported at each location or the 1972 variety tests. Yield data were based on the weight of cotton harvested from two-row plots. Each entry was randomized and replicated six imes.

Lint percentages and fiber property determinations were obtained from hand-picked samples. Fiber property data were determined by the U. S. Cotton Fiber Laboratory of the Agricultural Research Service, U. S. Department of Agriculture, Knoxville, Tennessee.

Performance data of varieties tested in 1972 are shown in Tables 1 through 7. Table 6 gives the average performance of 13 varieties grown at five locations in 1972. Table 7 gives the average performance of eight cotton varieties grown at five locations over a 3-year period (1970-72).

Table 1 gives results of the variety test conducted on a Bosket very fine sandy loam soil at Stoneville. This test was planted on April 19 and good stands were obtained. A prolonged summer drought at Stoneville reduced yields but caused the crop to mature early, and first harvest was made on September 13. Yields ranged from 685 to 1,043 pounds of lint per acre.

Table 2 gives the results of the variety tests conducted on a Dundee silty loam soil at Sumner. Rains throughout the summer caused later crop maturity, and the first harvest was made on October 18.

Very wet conditions during the later part of October and November delayed the final harvest until December 7. Yields at Sumner were high and ranged from 1,193 to 1,563 pounds of lint per acre.

Results at Stoneville on a Sharkey

clay soil are presented in Table 3. Yields on this site were higher than usual, which was probably caused by very timely rains during the growing season. Lint yields ranged from 723 to 1,014 pounds per acre. Fiber quality was better on this site than on the sandy soil site at Stoneville.

Table 4 gives the results of the variety test at Yazoo City. The total lint yield ranged from 785 to 1,114 pounds of lint per acre. This test was planted on April 21. It was harvested only once due to the early maturity caused by dry weather. Micronaire values were relatively high and fiber length was short at this location.

Results at Tunica are presented in Table 5. Lint yields ranged from 583 to 886 pounds per acre. This test was harvested only once because of the heavy rains during November and December. About 95% of the crop was harvested in the October 10 picking.

Table 6 gives the average performance of 13 varieties grown at five locations in 1972. Deltapine 5916-65 and Deltapine 25 were the highest-yielding varieties when averaged over all test environments.

The yield of these varieties was fairly consistent from one location to another, as neither variety ever ranked below fifth at any location. Deltapine 652-679, Stoneville 7A, Stoneville 213, Deltapine 16, and Coker 310 also had high average yields.

The average lint yield of eight cotton varieties grown at five locations for a 3-year period (1970-72) are presented in Table 7. The 3-year average shows Deltapine 25 to have the highest lint yields, followed very closely by Deltapine 16, Coker 310, Deltapine 45A, Stoneville 213, and Stoneville 7A.

These data show that varieties pla
important part in determining the yi
and quality of cotton. Yield is usu
the primary consideration in
selection of a variety, but ot
characteristics such as maturity, fi
quality, disease resistance, a
performance consistency should
considered.

Table 1. Results of 1972 Cotton Variety Test - Stoneville, Mississippi*

	LINT PER ACRE						FIBER PROPERTIES				
	Total	First pick	Percent first pick	Lint percent	Seed index	Boll size (grams)	Length 2.5%	Length 50%	Strength (gms/tex)	Elonga-tion	Micro-naire
	(lb.)	(lb.)									
Deltapine 652-679	1,043	854	82	40.9	9.6	5.63	1.09	.52	19.30	7.25	4.42
Deltapine 25	1 000	748	75	40.9	10.4	5.68	1.10	.52	20.50	6.82	4.79
Deltapine 5916-65	999	773	77	38.9	10.4	6.03	1.12	.55	20.51	8.44	4.85
Deltapine 16	973	763	78	38.9	10.8	6.29	1.13	.54	20.30	8.20	4.57
Stoneville 213	965	787	82	38.8	10.5	5.59	1.09	.50	19.40	6.52	4.78
Coker 310	959	792	83	39.3	10.8	6.20	1.16	.54	20.36	6.84	4.46
Stoneville 7A	951	708	74	39.6	10.1	5.50	1.11	.51	18.61	6.08	4.61
Coker 5110	947	775	82	37.9	11.1	6.65	1.14	.53	20.59	6.66	4.21
Stoneville 603	941	788	84	37.4	10.6	5.54	1.08	.51	19.77	7.09	4.15
Coker 8103	916	754	82	37.4	11.1	6.63	1.12	.54	20.65	6.41	4.12
Deltapine 45A	916	737	80	38.6	11.0	6.09	1.08	.53	19.72	7.13	4.67
Delcot 277	899	783	87	36.9	12.8	6.82	1.18	.56	22.62	8.22	3.74
McNair 511	808	603	75	35.7	11.1	5.58	1.09	.53	21.56	5.80	4.46
Acala 1517-70	735	546	74	35.8	11.4	5.58	1.14	.55	25.39	5.78	4.53
Lockett 4789A	685	502	73	34.3	12.1	6.36	1.08	.51	20.50	6.39	4.08
C.V.	8.1										
LSD .05	68										

Planted: April 19, 1972
Harvested: September 13 and October 24, 1972
***Soil: Bosket very fine sandy loam**

Table 2. Results of 1972 Cotton Variety Test - Sumner, Mississippi*

	LINT PER ACRE						FIBER PROPERTIES				
	Total	First pick	Percent first pick	Lint percent	Seed index	Boll size (grams)	Length 2.5%	Length 50%	Strength (gms/tex)	Elongation	Micronaire
	(lb.)	(lb.)									
Deltapine 5916-65	1,563	1,422	91	29.5	11.2	6.33	1.17	.58	19.80	8.51	5.08
Deltapine 25	1,515	1,318	87	40.0	11.9	6.07	1.18	.57	20.64	6.56	4.99
Stoneville 7A	1,515	1,369	90	38.1	12.0	6.03	1.18	.55	19.82	6.20	5.05
Coker 5110	1,501	1,347	90	37.9	13.0	6.77	1.24	.58	19.48	6.91	4.51
Deltapine 652-679	1,494	1,396	93	40.3	11.2	5.98	1.18	.57	18.87	7.42	4.81
Stoneville 213	1,483	1,366	92	37.2	12.5	6.39	1.16	.56	19.58	7.26	5.00
Delcot 277	1,469	1,367	93	36.3	14.5	6.37	1.23	.61	20.70	8.61	4.04
Coker 310	1,464	1,347	92	38.9	12.6	5.90	1.23	.56	20.05	6.07	4.81
Deltapine 45A	1,446	1,296	90	38.9	12.0	5.78	1.14	.57	19.80	7.24	4.83
Deltapine 16	1,441	1,297	90	38.4	12.0	6.59	1.21	.58	19.62	8.09	4.77
Coker 8103	1,426	1,265	89	37.2	13.0	6.42	1.23	.60	21.98	6.11	4.45
Stoneville 603	1,423	1,306	92	36.2	12.7	5.86	1.16	.54	19.13	7.17	4.42
McNair 511	1,193	976	82	35.2	13.7	5.59	1.16	.59	20.90	6.12	4.93
C.V.	7.36										
LSD .05	123										

Planted: April 25, 1972
Harvested: October 18 and December 7, 1972
***Soil: Dundee silty loam**

Table 3. Results of 1972 Cotton Variety Test - Stoneville, Mississippi*

	LINT PER ACRE						FIBER PROPERTIES				
							Length				
	Total	First pick	Percent first pick	Lint percent	Seed index	Boll size (grams)	2.5%	50%	Strength (gms tex)	Elongation	Micronaire
	(lb.)	(lb.)									
Deltapine 5916-65	1,014	948	93	38.5	10.5	5.45	1.16	.56	21.01	8.73	4.82
Deltapine 25	975	889	91	39.9	10.4	5.29	1.15	.56	19.86	6.99	4.67
Coker 310	966	894	93	39.0	11.3	5.38	1.20	.56	19.71	6.28	4.56
Deltapine 16	942	876	93	38.3	10.8	5.20	1.16	.55	19.65	8.50	4.66
Stoneville 7A	942	873	93	39.0	10.0	4.84	1.16	.55	18.18	6.04	4.86
Deltapine 652-679	941	880	94	40.3	9.7	4.94	1.14	.54	19.13	6.82	4.32
Stoneville 213	938	877	93	38.0	10.9	5.40	1.14	.55	18.96	7.12	4.77
Deltapine 45A	898	841	94	37.8	11.1	5.33	1.14	.56	20.44	9.09	4.53
Coker 5110	880	820	97	37.1	11.1	5.80	1.22	.58	20.36	7.00	4.15
Coker 8103	859	780	91	37.9	10.8	5.56	1.19	.56	20.28	6.20	4.11
Delcott 277	830	787	95	36.9	12.6	5.91	1.21	.57	21.50	8.41	3.86
Stoneville 603	754	684	91	36.7	11.0	4.78	1.12	.52	19.70	6.53	4.32
McNair 511	723	655	91	35.1	11.4	4.87	1.15	.56	22.35	6.58	4.77
C.V.	9.58										
LDS .05	99										

Planted: April 11, 1972
Harvested: October 3 and November 6, 1972
***Soil: Sharkey clay**

Table 4. Results of 1972 Cotton Variety Test - Yazoo City, Mississippi*

	LINT PER ACRE				*FIBER PROPERTIES*				
				Boll	*Length*				
	Total	*Lint percent*	*Seed index*	*size (grams)*	*2.5%*	*50%*	*Strength (gms/tex)*	*Elongation*	*Micronaire*
Deltapine 25	1,114	43.3	10.7	5.41	1.07	.54	18.85	6.76	5.38
Deltapine 5916-65	1,103	41.1	10.4	5.51	1.09	.55	20.64	8.61	5.25
Stoneville 213	1,093	40.6	10.5	5.37	1.08	.54	18.80	7.06	4.92
Stoneville 7A	1,086	41.5	10.5	5.37	1.10	.51	16.95	6.24	5.19
Stoneville 603	1,057	38.7	11.0	5.13	1.10	.53	20.00	7.68	4.39
Deltapine 16	1,051	41.3	10.6	5.78	1.09	.52	19.53	8.27	5.02
Coker 310	1,009	40.6	11.7	5.69	1.17	.56	19.80	6.72	4.83
Deltapine 652-679	1,006	43.3	9.8	5.26	1.08	.53	18.75	6.82	4.86
Coker 8103	973	38.7	11.1	5.41	1.16	.55	22.61	6.03	4.48
Coker 5110	971	40.0	10.9	6.03	1.12	.54	19.70	7.01	4.53
Delcott 277	968	39.1	12.5	5.89	1.17	.59	20.81	8.75	4.26
Deltapine 45A	930	40.6	10.9	5.33	1.05	.53	20.35	7.55	5.11
McNair 511	785	36.8	12.1	5.33	1.10	.55	19.73	5.96	4.87
C.V.	10.37								
LSD .05	121								

Planted: April 21, 1972
Harvested: October 5, 1972
***Soil: Sandy loam**

Table 5. Results of 1972 Cotton Variety Test - Tunica, Mississippi*

	LINT PER ACRE				FIBER PROPERTIES				
					Length				
	Total	Lint percent	Seed index	Boll size (grams)	2.5%	50%	Strength (gms/tex)	Elonga-tion	Micro-naire
	(lb.)								
Deltapine 652-679	886	39.8	10.4	5.20	1.12	.53	19.19	6.16	4.63
Deltapine 16	865	38.3	11.5	6.00	1.14	.55	20.37	7.87	4.67
Deltapine 25	860	39.2	11.0	5.49	1.14	.54	19.26	6.22	4.95
Stoneville 7A	859	37.5	11.4	5.53	1.16	.54	18.50	6.15	4.53
Deltapine 5916-65	856	38.5	10.8	5.86	1.15	.57	21.07	7.90	5.12
Stoneville 213	854	37.7	11.6	5.82	1.15	.54	19.68	6.30	4.81
Coker 310	839	40.6	11.2	5.81	1.15	.55	19.50	7.48	4.82
Deltapine 45A	815	38.5	11.3	5.47	1.07	.50	19.35	7.57	5.07
Coker 5110	799	37.6	12.0	6.12	1.17	.56	19.20	7.28	4.57
Stoneville 603	783	36.4	11.3	6.09	1.09	.51	19.62	6.65	4.54
Coker 8103	773	36.7	11.9	5.97	1.20	.58	21.78	6.47	4.26
Delcott 277	731	38.2	12.3	6.44	1.16	.55	21.75	8.01	4.32
Acala 1517-70	710	34.9	13.0	5.85	1.19	.56	25.47	5.56	4.00
McNair 511	680	36.0	11.5	5.15	1.09	.52	20.48	6.09	4.84
Lockett 4789A	583	35.1	12.7	6.61	1.09	.52	18.31	6.18	4.39
C.V.	12.54								
LSD .05	114								

Planted: April 27, 1972
Harvested: October 10,1972
***Soil: Sandy loam**

Table 6. Average Performance of 13 Cotton Varieties at Five Locations in 1972

	LINT PER ACRE				*FIBER PROPERTIES*				
					Length				
	Total	*Lint percent*	*Seed index*	*Boll size (grams)*	*2.5%*	*50%*	*Strength (gms tex)*	*Elongation*	*Micronaire*
	(lb.)								
Deltapine 5916-65	1,107	39.3	10.7	5.84	1.14	.56	20.61	8.44	5.02
Deltapine 25	1,093	40.7	10.9	5.59	1.13	.55	19.82	6.67	4.96
Deltapine 652-679	1,074	40.9	10.1	5.40	1.12	.54	19.05	6.89	4.61
Stoneville 7A	1,071	39.1	10.8	5.45	1.14	.53	18.41	6.14	4.85
Stoneville 213	1,067	38.5	11.2	5.71	1.12	.54	19.28	6.85	4.86
Deltapine 16	1,054	39.0	11.1	5.97	1.15	.55	19.89	8.19	4.74
Coker 310	1,047	39.7	11.5	5.80	1.18	.55	19.88	6.68	4.70
Coker 5110	1,019	38.1	11.6	6.27	1.18	.56	19.87	6.97	4.39
Deltapine 45A	1,001	38.9	11.3	5.60	1.10	.54	19.93	7.72	4.84
Stoneville 603	992	37.1	11.3	5.48	1.11	.52	19.64	7.02	4.36
Coker 8103	989	37.6	11.6	6.00	1.18	.57	21.46	6.24	4.28
Delcott 277	979	37.5	12.9	6.29	1.19	.58	21.48	8.40	4.04
McNair 511	838	35.8	12.0	5.30	1.12	.55	21.00	6.11	4.77

Table 7. Average Lint Yield of 8 Cotton Varieties at 5 Locations for a 3-Year Period (1970-72)

VARIETY TEST LOCATION	*YEAR*	*Stoneville 213*	*Deltapine 16*	*Deltapine 45A*	*Stoneville 7A*	*Stoneville 603*	*Delcott 277*	*Coker 310*	*Deltapine 25*
Stoneville (sand	1970	1305	1308	1285	1304	1127	1122	1187	1411
Stoneville (sand)	1971	1132	1183	1178	1079	1102	1198	1133	1186
Stoneville (sand)	1972	965	973	916	951	941	899	959	1000
Average	--	1134	1155	1126	1111	1057	1073	1093	1199
Stoneville (clay)	1970	311	427	466	346	391	311	403	438
Stoneville (clay)	1971	585	557	551	627	490	611	581	621
Stoneville (clay)	1972	938	942	898	942	754	830	966	975
Average	--	611	642	638	638	545	584	650	678
Yazoo City	1970	1004	997	1011	932	854	780	955	984
Yazoo City	1971	660	654	711	625	620	576	795	752
Yazoo City	1972	1093	1051	930	1086	1057	968	1009	1114
Average	--	919	901	884	881	844	775	920	950
Tunica	1970	789	902	843	778	861	764	824	835
Tunica	1971	932	960	1014	970	890	1022	975	998
Tunica	1972	854	865	815	859	783	731	839	860
Average	--	858	909	891	869	845	839	879	898
Sumner	1970	1356	1357	1339	1329	1259	1142	1345	1359
Sumner	1971	1467	1404	1515	1462	1409	1480	1533	1519
Sumner	1972	1483	1441	1446	1515	1423	1469	1464	1515
Average	--	1435	1401	1433	1435	1364	1364	1447	1464
3-Yr Ave 5 Locations	--	992	1001	995	987	931	927	998	1038

Cotton Variety Performance in the Hill Section in 1972

Cotton variety tests were planted at six locations in the Hill Section of Mississippi in 1972. The test at Verona was lost because of early fall rains which prevented harvesting. A list of the five locations from which data were obtained, along with soil type and pertinent cultural practices, is given in Table 1.

Twenty varieties were uniformly included in the test at each location. Of these, five were being tested at these locations for the first time. These were : Deltapine 652-67972, Delcott 277, Coker 5110, Stoneville 7A Nectariless, and Frego Smooth Nectariless.

A list of the varieties tested, lint yields obtained at each location, and average yield in the Hill Section tests in 1972 are given in Table 2, and three-year averages for eleven varieties are given in Table 3.

Yield and yield components that reported include lint per acre, lint p centage, and bolls per pound of s cotton. Percent of the total y obtained at first harvest is also inclu for the Brooksville location, and ma useful as an indication of earlines maturity.

Classer's staple length in 32nds i and micronaire were provided for e variety by the U.S.D.A. Cotton Cl ing Office, Jackson. Fiber stren 2.5% span length, and uniformity r were obtained from a commer testing company.

Data for each location in 1972 three-year averages are given in Tal 3-12.

Table 1. Cultural practices used at cotton variety test locations in 1972.

Location	Soil Type	$N\text{-}P_2O_5\text{-}K_2O$ Fertilizer	Plot Size Length	Plot Size Width	Plantin Date
		lbs./A	ft.	no. rows	mo./da
State College	Leeper fine sandy loam	70-52-52	30	1	5/19
Brooksville	Houston clay	65-65-65	150	1	5/2
Raymond	Grenada silt loam	75-60-60	28	1	5/18
Pontotoc	Atwood silt loam	100-52-52	30	1	4/25
Holly Springs	Grenada silt loam	60-60-60	70	1	5/12

Table 2. Lint yield, in pounds per acre, of 20 cotton varieties tested at 5 locations in the Hill Section in 1972.

Variety	State College	Brooks-ville	Raymond	Pontotoc	Holly Springs	Ave.
Hybee 200A	740	702	964	595	988	797.8
Stoneville 213	642	649	970	630	763	730.8
DES 67-213	630	648	964	597	811	730.0
Stoneville 7A	609	540	994	569	819	706.2
Hybee 100A	654	680	897	546	697	694.8
Deltapine 6225	552	642	960	584	731	693.8
Hancock	489	597	1029	563	773	690.2
Deltapine 16	759	622	892	540	672	687.0
Deltapine 652-67972	469	677	1019	589	640	678.8
Coker 310	675	592	1067	547	497	675.6
Coker 417	713	720	888	489	552	672.4
Dixie King II	333	673	1082	512	694	658.8
Delcott 277	436	568	1015	584	647	650.0
Coker 5110	523	571	989	600	557	648.0
Deltapine 45A	592	560	904	460	617	626.6
Stoneville 7A Nectariless	524	446	792	444	882	617.6
La. Frego 2	574	536	818	427	696	610.2
Stoneville 603	377	547	885	534	701	608.8
Coker 201	562	525	809	459	575	586.0
Frego Smooth Nectariless	501	712	753	378	347	538.2
Average	567.7	610.3	934.5	532.3	680.4	665.1

Acknowlegement and appreciation is expressed to the following organizations, which provided seed of the indicated varieties:

Delta and Pine Land Company, Scott, Mississippi: *Deltapine 6225, Deltapine 16, Deltapine 652-67972, Deltapine 45A.*

Stoneville Pedigreed Seed Company, Stoneville, Mississippi: *Stoneville 213, Stoneville 7A, Stoneville 603, Dixie King II.*

Coker Pedigreed Seed Company, Hartsville, South Carolina: *Coker 310, Coker 417, Coker 5110, Coker 201.*

Pennington Grain and Seed, I Madison, Georgia: *Hybee 100A, Hy 200A.*

Delta Branch Experiment Stati Stoneville, Mississippi: *DES67-213.*

West Tennessee Experiment Stati Jackson, Tennessee: *Hancock.*

Delta Center, Portageville, Misso *Delcot 277.*

Boll Weevil Research Laborato Mississippi State, Mississip *Stoneville 7A Nectariless, La Frego Frego Smooth Nectariless.*

Table 3. Three-year average lint yield of 11 cotton varieties tested at 6 locations in Hill Section in 1970-1972.

Variety	*State College*	*Brooks-ville*	*Raymond**	*Ponto-toc*	*Holly Springs*	*Verona***	*Av*
Stoneville 213	685	669	1021	873	748	904	816
Coker 310	679	664	1020	613	755	828	759
Deltapine 6225	648	698	975	583	809	829	757
Deltapine 16	738	627	981	617	767	774	750
Hancock	685	685	912	590	801	812	747
Stoneville 7A	611	623	948	575	868	800	737
Coker 417	690	657	920	578	748	814	734
Dixie King II	506	707	977	611	767	814	730
Coker 201	697	609	899	597	708	795	717
Stoneville 603	587	521	904	588	806	822	704
Deltapine 45A	689	631	868	543	703	756	698
Average	654.0	644.6	947.7	615.2	770.9	813.0	741

* Two-year average, 1970 and 1972.

** Two-year average, 1970 and 1971.

ble 4. Cotton variety performance at the Black Belt Branch Experiment Station, Brooksville, in 1972.

riety	Lint/ Acre	Lint %	Bolls Lb.	% 1st Picking	Fiber Properties Staple	Mike
	lbs.	%	no.	%	1/32 in.	Index
oker 417	720	36.0	68	89	35	4.8
ego Smooth Nectariless	712	34.6	71	83	35	4.9
ybee 200A	702	38.3	70	89	35	4.8
ybee 100A	680	35.3	73	90	35	4.8
ltpine 652-67972	677	36.5	68	90	35	4.7
xie King II	673	39.3	68	88	35	5.1
oneville 213	649	37.6	73	88	35	4.8
ES 67-213	648	36.6	67	90	35	4.3
eltapine 6225	642	36.0	70	91	35	4.6
eltapine 16	622	34.3	68	90	36	4.5
ancock	597	35.3	66	93	35	4.4
oker 310	592	36.6	68	87	36	4.5
oker 5110	571	35.3	69	88	36	4.5
elcott 277	568	36.3	68	91	36	4.3
eltapine 45A	560	34.0	73	91	34	4.8
oneville 603	547	34.6	66	88	36	4.3
oneville 7A	540	36.0	66	88	35	5.1
. Frego 2	536	31.0	64	86	35	5.0
oker 201	525	35.3	68	90	36	4.6
oneville 7A Nectariless	446	35.3	71	90	35	4.6
Average	610	35.7	69	89	35	4.7
.S.D. at .05	123					
.01	163					

able 5. Three-year averages, Black Belt Branch Experiment Station, Brooksville, in 1970-1972.

ariety	Lint/ Acre	Lint %	Bolls/ Lb.	Fiber Properties Staple	Mike
	lbs.	%	no.	1/32 in.	Index
ixie King II	707	38.3	62	34	4.8
eltapine 6225	698	39.1	78	35	4.8
ancock	685	37.3	63	34	4.7
toneville 213	669	38.1	74	35	5.0
oker 310	664	38.7	75	36	4.7
oker 417	657	36.4	70	35	4.6
eltapine 45A	631	37.0	76	34	4.9
eltapine 16	627	36.1	73	35	4.5
toneville 7A	623	38.0	72	35	5.1
oker 201	609	38.2	71	35	4.6
toneville 603	521	35.0	73	35	4.5
Average	644	37.4	71	35	4.8

Table 6. Cotton variety performance at the Pontotoc Branch Experiment Statio Pontotoc, 1972.

Variety	Lint/ Acre	Lint %	Bolls/ Lb.	Fiber Properties	
				Staple	Mike
	lbs.	%	no.	1/32 in.	Index
Stoneville 213	630	39.1	84	34	5.0
Coker 5110	600	39.2	78	34	4.3
DES 67-213	597	39.3	83	33	4.5
Hybee 200A	595	40.2	82	33	5.1
Deltapine 652-67972	589	42.6	82	34	4.6
Delcott 277	584	39.5	74	35	4.1
Deltapine 6225	584	40.5	81	34	5.1
Stoneville 7A	569	39.4	86	34	4.9
Hancock	563	39.2	70	33	4.8
Coker 310	547	40.1	79	34	4.9
Hybee 100A	546	38.2	76	34	4.7
Deltapine 16	540	38.2	75	34	4.8
Stoneville 603	534	37.4	82	33	4.6
Dixie King II	512	38.6	66	33	4.8
Coker 417	489	38.1	78	34	4.2
Deltapine 45A	460	38.9	86	34	4.3
Coker 201	459	40.6	78	34	4.8
Stoneville 7A Nectariless	444	37.8	82	34	4.8
La Frego 2	427	37.0	79	33	5.3
Frego Smooth Nectariless	378	36.0	95	32	5.3
Average	532	38.9	80	34	4.7
L.S.D. at .05	113				
at .01	150				

Table 7. Three-year averages, Pontotoc Branch Experiment Station, Pontotoc, 1970-1972.

Variety	Lint/ Acre	Lint %	Bolls/ Lb.	Fiber Properties	
				Staple	Mike
	lbs.	%	no.	1/32 in.	Index
Deltapine 16	617	39.5	81	34	5.0
Coker 310	613	40.6	74	35	5.0
Stoneville 213	611	39.5	80	34	5.2
Dixie King II	611	39.5	66	33	4.9
Coker 201	597	41.0	76	34	4.9
Hancock	590	40.2	71	33	4.8
Stoneville 603	588	37.8	80	34	4.9
Deltapine 6225	583	41.3	85	34	5.2
Coker 417	578	39.1	77	34	4.5
Stoneville 7A	575	40.1	83	34	5.1
Deltapine 45A	543	49.5	83	34	4.9
Average	591	39.8	78	34	4.9

ble 8. Cotton variety performance at North Mississippi Branch Experiment Station, Holly Springs, in 1972.

iety	Lint/ Acre lbs.	Lint % %	Bolls/ Lbs. no.	Fiber Properties				
				Staple Length 1/32 in.	Mike Index	Strength M.P.S.I.	2.5% Span In.	UR %
bee 200A	988	43	83	34	4.8	86	1.00	46
neville 7A Nectariless	882	40	82	34	5.2	90	.98	45
neville 7A	819	42	83	34	4.9	91	1.02	46
S 67-213	811	41	83	34	4.8	86	1.03	47
neville 213	763	41	82	33	5.2	80	1.00	46
ltapine 6225	731	44	86	34	5.2	91	1.02	48
neville 603	701	39	83	34	4.7	88	1.05	47
bee 100A	697	40	80	35	4.8	89	1.05	46
Frego 2	696	40	76	34	5.2	87	1.03	48
xie King II	694	40	63	33	4.7	90	1.02	46
lcot 277	647	40	73	34	4.5	90	1.07	48
ltapine 652-67972	640	43	93	33	4.9	90	1.07	48
ltapine 16	622	41	81	34	4.8	85	1.03	49
ltapine 45A	617	41	85	33	5.1	84	1.04	49
ker 201	575	42	80	34	4.8	93	1.03	48
ker 5110	557	40	74	34	4.9	89	1.07	47
ker 417	552	40	85	34	4.5	94	1.07	48
ker 310	497	42	80	34	5.0	94	1.11	47
ego Smooth Nectariless	347	38	95	33	5.4	87	1.01	46
Average	680	41.0	80	34	4.9	89	1.03	47
S.D. at .05	115							
at .01	152							

ble 9. Three-year averages North Mississippi Branch Experiment Station, Holly Springs, 1970-1972.

ariety	Lint/ Acre lbs.	Lint % %	Bolls/ Lbs. no.	Fiber Properties				
				Staple Length 1/32 in.	Mike Index	Strength* M.P.S.I.	2.5%* Span In.	UR* %
toneville 7A	868	40.4	74	34	5.2	87	1.08	47
eltapine 6225	809	41.8	82	34	5.2	90	1.09	49
toneville 603	806	39.2	79	34	4.8	85	1.09	47
ancock	801	40.4	69	33	4.9	87	1.06	47
eltapine 16	767	39.9	76	34	5.0	82	1.10	49
ixie King II	767	40.0	62	34	5.0	87	1.07	48
oker 310	755	42.4	80	35	5.1	88	1.18	48
oker 417	748	40.4	79	35	4.6	90	1.12	48
toneville 213	748	40.0	80	34	5.4	79	1.08	48
oker 201	708	41.0	79	34	5.0	90	1.09	49
eltapine 45A	703	40.6	82	34	5.1	82	1.08	49
Average	770	40.5	76	34	5.0	86	1.09	48

Two-year averages 1971 and 1972.

Table 10. Cotton variety performance at the Brown Loam Branch Experiment Stati
Raymond, in 1972.

Variety	Lint/ Acre lbs.	Lint	Bolls/ Lbs. no.	Fiber Properties Staple Length 1/32 in.	Mike Index	Strength M.P.S.I.	2.5% Span In.	U
Dixie King II	1082	39.6	63	34	4.7	84	1.05	4
Coker 310	1067	41.6	77	35	4.7	87	1.15	4
Hancock	1029	40.3	72	33	4.8	93	1.02	4
Deltapine 652-67972	1019	42.3	81	34	4.8	85	1.08	4
Delcot 277	1015	42.3	76	36	4.3	85	1.13	4
Stoneville 7A	994	41.3	95	34	5.0	90	1.08	4
Coker 5110	989	42.3	76	36	4.6	86	1.13	4
Stoneville 213	970	40.0	79	34	5.0	90	1.07	4
DES 67-213	964	40.3	93	34	4.4	87	1.07	4
Hybee 200A	964	39.3	83	35	4.8	89	1.11	4
Deltapine 6225	960	42.0	85	34	5.4	87	1.07	4
Deltapine 45A	904	40.3	80	34	5.0	82	1.05	4
Hybee 100A	897	39.3	78	34	4.7	87	1.12	4
Deltapine 16	892	40.0	72	35	5.0	85	1.08	4
Coker 417	888	39.0	77	35	4.4	93	1.09	4
Stoneville 603	885	38.6	88	35	4.5	89	1.06	4
La. Frego 2	818	40.0	88	33	4.8	91	1.02	4
Coker 201	809	41.0	81	35	4.6	87	1.06	4
Stoneville 7A Nectariless	792	38.3	83	35	4.8	89	1.04	4
Frego Smooth Nectariless	792	35.6	103	32	5.1	88	1.01	4
Average	936	40.4	81	34	4.8	88	1.07	4
L.S.D. at .05	NS							
at .01	NS							

Table 11. Two-year averages Brown Loam Branch Experiment Station, Raymon
1970 and 1972.

Variety	Lint/ Acre lbs.	Lint %	Bolls/ Lb. no.	Fiber Properties Staple Length 1/32 in.	Mike Index	Strength M.P.S.I.	2.5% Span In.	U %
Stoneville 213	1021	40.4	79	34	5.2	88	1.08	4
Coker 310	1020	41.3	75	35	4.9	88	1.13	4
Deltapine 16	981	41.7	74	35	5.2	83	1.09	4
Dixie King II	977	38.3	65	34	5.1	84	1.05	4
Deltapine 6225	975	41.6	81	34	5.3	86	1.08	4
Stoneville 7A	948	40.7	87	34	5.3	89	1.09	4
Coker 417	920	38.8	74	34	4.8	90	1.07	4
Hancock	912	40.6	74	34	4.9	90	1.06	4
Stoneville 603	904	38.6	84	35	5.0	87	1.08	4
Coker 201	899	40.6	79	35	5.0	88	1.06	4
Deltapine 45A	868	40.1	77	34	5.3	82	1.08	4
Average	947	40.2	77	34	5.1	87	1.07	4

le 12. Cotton variety performance at Central Station, State College, in 1972.

iety	Lint/ Acre	Lint %	Bolls/ Lb.
	lbs.	%	no.
tapine 16	759	38.2	74
ee 200A	740	40.2	79
ker 417	713	38.1	77
ker 310	675	40.1	76
ee 100A	654	38.2	76
neville 213	642	39.1	79
S 67-213	630	39.3	81
neville 7A	609	39.4	82
tapine 45A	592	38.9	81
Frego 2	574	37.0	76
ker 201	562	40.6	76
tapine 6225	552	40.5	80
neville 7A lectariless	524	37.8	79
ker 5110	523	39.2	74
go Smooth lectariless	501	36.0	91
ncock	489	39.2	69
tapine 652-67972	469	42.6	81
cott 277	436	39.5	72
neville 603	377	37.4	79
ie King II	333	38.6	65
verage	568	38.9	77
.D. at .05	NS		
at .01	NS		

le 13. Three-year averages, Central Station, State College, 1970-1972.

riety	Lint/ Acre	Lint %	Bolls Lb.
	lbs.	%	no.
ltapine 16	738	38.3	77
ker 201	697	39.2	78
ker 417	690	38.3	76
ltapine 45A	689	39.2	81
ncock	685	38.8	69
neville 213	685	38.7	79
ker 310	679	38.2	79
ltapine 6225	648	40.4	80
neville 7A	611	38.8	83
neville 603	587	38.3	81
kie King II	506	37.8	61
verage	655	38.7	77

Table 14. Two-year averages, Northeast Mississippi Branch Experiment Stati Verona, in 1970-1971.

Variety	*Lint/ Acre*	*Lint %*	*Bolls/ Lb.*	*Fiber Properties*	
				Staple	*Mik*
	lbs.	%	no.	1/32 in.	Inde
Dixie King II	814	36.4	59	35	4.6
Deltapine 6225	829	39.4	81	35	4.7
Hancock	812	38.5	70	34	4.5
Stoneville 213	904	38.0	79	35	4.9
Coker 310	828	37.9	84	36	4.2
Coker 417	814	36.1	75	36	4.2
Deltapine 45A	756	37.1	80	35	4.8
Deltapine 16	774	37.1	79	35	4.5
Stoneville 7A	800	39.1	81	34	4.8
Coker 201	795	39.1	76	35	4.6
Stoneville 603	822	36.0	80	35	4.7
Average	818	37.7	77	35	4.5

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Mississippi Agricultural and Forestry Experiment Station

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Production Of Cucumbers For Pickles

ie cucumber is one of the most ortant vegetable crops produced in sissippi in terms of acreage and e and is the most important :table crop grown for processing. duction in 1972 was approximately 00 acres and yield per acre averaged roximately 3 tons. Growers in at : 74 of the 82 counties in the state duced cucumbers under contract for les in 1972. Cucumbers are grown in areas of the state, from north to h, and from east to west.

ickling cucumbers, as currently duced, are uniquely adapted to the ll family farm. When harvest begins, labor requirements of the crop eases markedly and the crop 'ides a market for young, relatively :illed labor as well as a good source dditional income to the farmer.

Types of Cucumbers

ie cucumber is divided into two er broad types, depending upon the ket for which it is produced. group, known as the fresh market icing type, produces dark green fruit is grown primarily for sale on the n market. There is little acreage of type in Mississippi. The principle grown in Mississippi is for pickl- in which the fruit are lighter green in r and shorter in length. They are lly grown under contract for pickle panies. The pickling type may be :r black spined or white spined. The es on the fruit are not very :eable, but can be detected by close nination. The black spined cultivars haracterized by the development of 'pical yellow color as the fruit ires. The white spine varieties do turn yellow with maturation. The mber is further sub-divided nding upon the flowering habit of particular cultivar. Some are known onoecious and others are known as pecious. The monoecious cultivars uce both male and female flowers he same plant, but in separate ers with the male flower occurring est and by far the greatest in ber. Tte gynoecious type produces primarily female flowers. In planting the gynoecious types the seeds should be mixed with a pollinator type to insure sufficient male flowers to effect pollination. These will be discussed more fully under cultivars.

Size of Plantings

The cucumber is frequently referred to as an intensive labor crop, that is it requires a relatively large amount of labor, particularly at harvest time. Most of the cucumbers in Mississippi are grown on small farms and harvested by the farm family. Due to the frequency of harvests required, it is necessary that plantings be limited in size to 5 acres or less. In some areas of the state where mechanization of harvest is more complete, larger acreages are common. A planting should not exceed that which the labor force can harvest twice a week. If plantings are harvested less than twice a week, yields will be considerably below maximum, the fruit grade will be reduced and returns will be well below the crop potential.

Climatic Requirements

The cucumber is generally referred to as a warm season crop, that is it does best in the warmer season of the year. The best average temperature range for cucumber production is between 60 and 75°F. At temperatures below 60°F, growth is poor. At temperatures above 90 to 95°F growth is also poor and the activity of bees is low and pollination is hampered resulting in misshapen fruit. The cucumber is very susceptible to frost injury and should not be planted before the danger of frost has passed.

Soils

The cucumbers can be grown quite successfully on a wide range of Mississippi soils. The two most important requirements to consider in selecting a soil or field for the production of cucumbers are: (1) drainage, the field must be well drained, and (2) herbicide residues, if there is a likelihood of a chemical residue having persisted from a previous crop usage, that field should be avoided for cucumbers. Figure 1 is a photograph of a portion of a field 2 weeks after planting. The field was part of a corn herbicide test the preceding year. Note the variation in plant stand. Figure 2 is another view of the same field two weeks later. A plant stand of this type would be disastrous for a grower.

The cucumber does best on a sandy loam to loam soil; however, it will do quite satisfactorily on other soil types. If the soil tends to crust this may be a problem in getting a good stand; however, corrective measures can be taken to enhance the stand. If the soil is excessively sandy, the use of irrigation water will become more important, particularly if rainfall is deficient. For best crop uniformity and production, soil should be relatively uniform throughout the field and it should be free, as much as possible, of debris such as stones and organic residue from previous crops. The soil should be throughly broken, well pulverized, and the beds formed several days prior to planting. The soil should be allowed to settle before planting as this will improve contact with the seed and facilitate germination. It also makes a uniform planting depth easier to attain.

Fertilization

Mississippi crop and fertilizer recommendations have for several years suggested a preplant application of 40 pounds of nitrogen and 80 pounds each of phosphorus and potassium plus 30 pounds of nitrogen as a sidedress application for cucumber production. As cucumber production became more widely spread over the state, interest developed in the adequacy of cultural recommendations.

In 1966 a study was initiated at the North Mississippi Branch Station at Holly Springs to determine the best rate of fertilization and number of plants per acre. Two basic preplant fertilizers rates were used: (1) 60 pounds of nitrogen and 90 pounds each of phosphorus and potassium per acre and, (2) 90 pounds of nitrogen and 120 pounds each of phosphorus and potassium per acre.

The fertilizer was applied in the row approximately 7 to 10 days prior to planting. Plots were side dressed with either 30 or 60 pounds of nitrogen when the plants reached the 4 to 6 leaf stage. Plant spacings used were based on 40-inch rows and plants were spaced 6, 12 or 18 inches in the row. Plots, 1 row 20 feet long, were over seeded and thinned to the desired stand when the first leaf began to expand. Supplementary irrigation was supplied as needed to maintain favorable moisture conditions. When the plants reached t
4 to 6 leaf stage, DCPA (Dacthal) at
pounds per acre was applied broadca
to control weeds. The plots we
sprayed as needed to control insects.

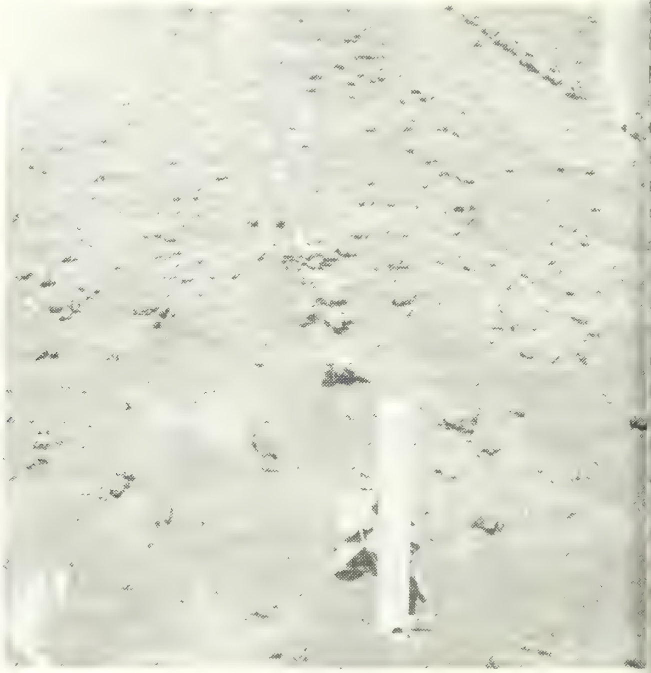
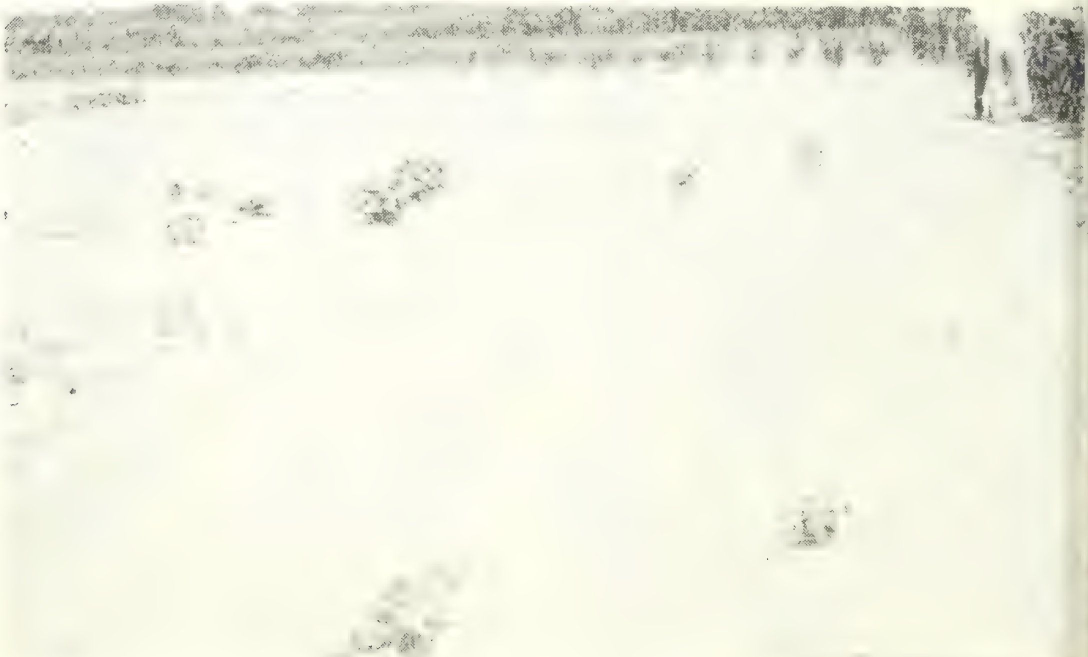


Figure 1. A view of a cucumber planting 2 weeks after seeding in a field utilized the previous year for a corn herbicide study. Note the dead plants in the row in the foreground.

Figure 2. Another view of the field shown in the preceding figure. This photograph was made 2 wee
later or 4 weeks after seeding.



arvest began when the first fruits hed No. 3 size and continued twice :ly for 6 weeks. Fruit were separated rades and weighed. The grade basis was: No. 1 - up to 1-1/16 inches in ieter, No. 2 - from 1-1/16 to 1-1/2 es in diameter, No. 3 from 1-1/2 to 2 es in diameter, No. 4 - from 2 to 2- inches in diameter, No. 5 - from 2- :o 2-1/2 inches in diameter and No. ıver 2-1/2 inches in diameter.

ıe data are presented in Table 1. erences in total yield due to the lant fertilizer application or the ›gen sidedress were not significant; ever, the yield of No. 4 fruit was rally higher in the high nitrogen ;. This was probably due to the fact the higher nitrogen application ed a more vigorous vine and foliage /th and made it more difficult to the smaller fruit at harvest time. erally, the 12 inch spacing was rior to either the 6 or 18 inch ing, again due in part at least to ge density.

ısed on these tests, preplant lizer applications should supply ıt 60 pounds of nitrogen and 90 ıds each of phosphorus and ssium per acre. The fertilizer may pplied at planting time or at bedd- ime. It should be applied in bands ither side of the row and should be 'oximately 2 inches to one side and 2 es below the seed depth at planting. ldition, a sidedress application of 30 pounds or more of nitrogen per acre should be made when the plants have 4 to 6 true leaves. This sidedress application should be 4 to 6 inches to the side of the plants with care taken to avoid getting the material on the plants and thus causing foliage burn. If the soil is relatively fertile, the nitrogen application should not exceed 120 pounds per acre on a fairly fertile soil.

Spacing

Cucumbers are grown at various plant spacings for hand harvest; however, the number of plants per acre is an important factor in determining the yield. The cucumber crop should be fitted into the overall farm program rather than attempting to adapt the other crops and practices to cucumbers. Row width may vary from 36 to 44 inches, depending upon the equipment available. Seeds should be sown thickly enough to insure 1 to 2 plants per 12 inches of row, on rows 36 to 44 inches wide. Plant populations greater than this tend to increase the water requirements on a per acre basis and do not yield more on a hand harvested operation. Fewer plants than 1 per 12 inches of row results in decreased yields; therefore, every effort should be made to insure 1 plant per 12 inches of row (a population of 11,000 to 13,000 plants per acre).

Several plant spacing studies have been conducted over the past few years. The data presented in Table 1 is a part of this work. Regardless of the fertilizer rate, the 12 inch spacing between plants was best.

A study was conducted in 1969 and 1970 to measure the influence of spacing on yield in irrigated vs non-irrigated plots. Plots 20 feet long and 40 inches wide were fertilized with 60 pounds of nitrogen and 90 pounds each of phosphorus and potassium, overseeded and thinned to the appropriate stand when the first leaf began expanding. The plots were sidedressed with 45 pounds of nitrogen at the 4 to 6 leaf stage and sprayed with DCPA at 10 pounds per acre broadcast. Yield data are presented in Table 2. Irrespective of irrigation, the 12 inch spacing produced the greatest yield. Regardless of the spacing between plants, supplementary irrigation resulted in a highly significant increase in yield. The more dense the plant population, the greater was the benefit from irrigation. No real benefit was gained from greater populations on a hand harvested basis except when the plots were irrigated. Greater populations require more seed and, if the season should be drier than normal, would require more irrigation water.

Varieties and Seeding Dates

Since most pickling cucumbers are grown under contract in Mississippi the growers must use the cultivar that is specified by the processor. In general the

e 1. Yield by grade of cucumbers (cultivar Ohio MR-17) in hundred weights per acre (cwt/a) as influenced by plant spacing and rate of fertilization. Data represent means for 3 years - 1966, 1967 and 1968 at Holly Springs.

	Fertilizer Preplant		*Sidedress*	*Spacing*	*Yield (cwt./a)*				
	P	*K*	*N*		*No. 1*	*No. 2*	*No. 3*	*No. 4*	*Total*
	90	90	30	6	17.6	59.4	87.2	20.1	184.3
				12	20.6	69.3	104.4	24.6	218.9
				18	18.5	60.1	89.9	25.1	193.6
	90	90	60	6	18.4	48.6	87.4	26.7	181.1
				12	21.2	68.3	102.2	32.1	223.8
				18	19.1	62.8	94.5	31.8	208.2
	120	120	30	6	20.9	68.5	104.4	29.6	223.4
				12	23.3	76.3	110.6	35.4	245.6
				18	19.5	59.3	89.4	24.9	193.1
	120	120	60	6	18.5	61.8	88.9	37.9	207.1
				12	23.6	76.6	113.8	40.4	254.4
				18	17.4	58.3	89.9	31.5	197.1
S at 5% - Fertilizer					2.5	10.1	16.2	4.8	39.7
at 1%					3.4	14.0	22.4	6.1	53.1
S at 5% - Spacing					1.5	4.6	11.4	3.9	27.9
at 1%					2.0	6.2	15.4	5.3	37.3

gynoecious hybrids yield far superior to the monoecious cultivars. A typical gynoecious hybrid is shown in Figure 3. Note the presence of female flowers (as depicted by the small cucumbers) at each leaf axis on the vine. Figure 4 is a photograph of a typical monoecious plant that has not yet produced a female flower as shown by the absence of cucumbers.

Cultivar tests have been conducted at the North Mississippi Branch Experiment Station, the Coastal Plains Branch Experiment Station and at Mississippi State University since 1965 with tests at 2 or more of the above locations each year. Single row plots 20 feet long were replicated 4 times for each cultivar. Plots were over seeded in early May each year and thinned to 1 plant per linear foot of row when the first leaf began expanding. Fertilizer at the rate of 500 pounds per acre of 12-16-16 was applied in the row prior to seeding. An additional 30 pounds of nitrogen per acre was applied as a sidedress at the 4 to 6 leaf stage. Weeds were controlled by cultivation up to the 6 leaf stage of crop development and then by applying 10 pounds DCPA per acre, broadcast.

Harvest was twice weekly beginning when the first fruit reached No. 3 size (Figure 5). Data, showing typical average yields for both monoecious cultivars and gynoecious hybrids, are presented in Table 3. Although the data are averages for several years, not all cultivars were grown at any one location any given year. Explorer, Ranger, Galaxy, Pioneer and Southern Cross are gynoecious hybrids. In general they did not continue to produce well in the late part of the season, but produced a far larger part of their total yield in the earlier part of the season.

Not one of the cultivars tested was best at all locations any test year. No cultivar was best at one location over all the years of the tests. Regardless of the cultivar a grower plants, he should be certain that it is one the processor will accept.

A number of the newer cultivars have good to excellent resistance to some of the diseases that are likely to occur in the crop. When disease resistance is available, it would be used.

The cucumber may be grown as both a spring and a fall crop throughout Mississippi. As a spring crop, planting may take place beginning in South Mississippi around March 20 and going through until about May 15 in North Mississippi. As a fall crop it may be planted in north Mississippi beginning about July 15 and planted through about August 30 in south Mississippi. Seeds should be planted from approximately ¾ inch to 1-1/2 inches in depth, depending on the time of year and soil moisture conditions. As soon as germination is complete and the young plants have become established, the stand should be thinned to the desired population. Approximately 2 to 3 pounds of seed are required to plant 1 acre.

Cultivation

The root system of the cucumber is relatively shallow, rarely penetrating depths exceeding 18 inches; however, it is quite extensive throughout the rows and middle of the field. Any cultivation must be shallow. The field should be cultivated only as is necessary to control weeds and grasses and provide for adequate aeration of the soil. If crusts form they should be broken. More frequent cultivations and deep cultivations would cause more damage than benefit in that they would tend to destroy the root system of the crop. After vine growth becomes evident the field should not be cultivated since it only damages the root system and the vines.

Weed Control

The cucumber is very sensitive to most herbicides. Best plant growth will be obtained if weeds are controlled by cultivation until the plant reaches the 4 to 6 leaf stage. When the plant reaches this stage of development cultivation becomes difficult and weeds may be controlled using one of several recommended herbicides. Recommended materials include: DCPA (Dacthal) and CDEC (Vegedex) and NPA (Alanap). The grower is referred to the Mississippi Weed Control Handbook (obtainable from County Agents and District Extension personnel) for rates and methods of application of these materials. The grower is cautioned not to exceed the recommended rate for any of the above materials. Even at this stage of plant development severe stunting will result if excess amounts of herbicides are supplied.

Irrigation

For profitable yields, the cucun
crop requires a rather constant supp
moisture. This is especially true du
the period of flowering and
development. During most produc
seasons in Mississippi, there are per
when the grower would be
markedly from the use of irrigatio
shown in Table 2. This is particul
true on the sandier soils. The h
soils, the silts and clays, have relati
high moisture holding capacity
normal rainfall often will be f
adequate for these; however, there
periods when even these soils be
from supplementary water. Source
water for irrigation purposes inc
such things as farm ponds, flo
streams, and wells. The cucumber
should have available from 1 to 1
inches of water per week depen
upon the soil type, the stage of
development and climatic conditio
normal rainfall is below this l
supplementary water would pro
marked benefits. Water should n
applied during the late forenoon or
afternoon. Water droplets on the
leaves magnify the sun rays and c
"burning" of the foliage.

Harvesting

About 6 weeks after the y
seedling emerges from the soil, the
begins to produce flowers. The mal
female flower parts are in sep
flowers on the monoecious varieties
are for the most part on separate p
in the gynoecious hybrids (Figures
4). A good bee population in the vic
of the planting is necessary for adeq
pollination and fruit set. The ra
development of the cucumber fruit
studied at Mississippi State Unive
Two hundred female flowers were c
and tagged on the day the flower op
and the diameter and length o
young fruit was measured.
approximately the same hour o
next 18 days the length and diamet
each fruit were again measured.
average growth rate of the
cucumber fruit is presented in Fig
The curves show that the cucu
developed very rapidly in both le
and diameter. Once the fruit reache
number 1 size, it passed from one s
the next very rapidly. This
particularly true in the number 2,
4 size range. Seven days from the

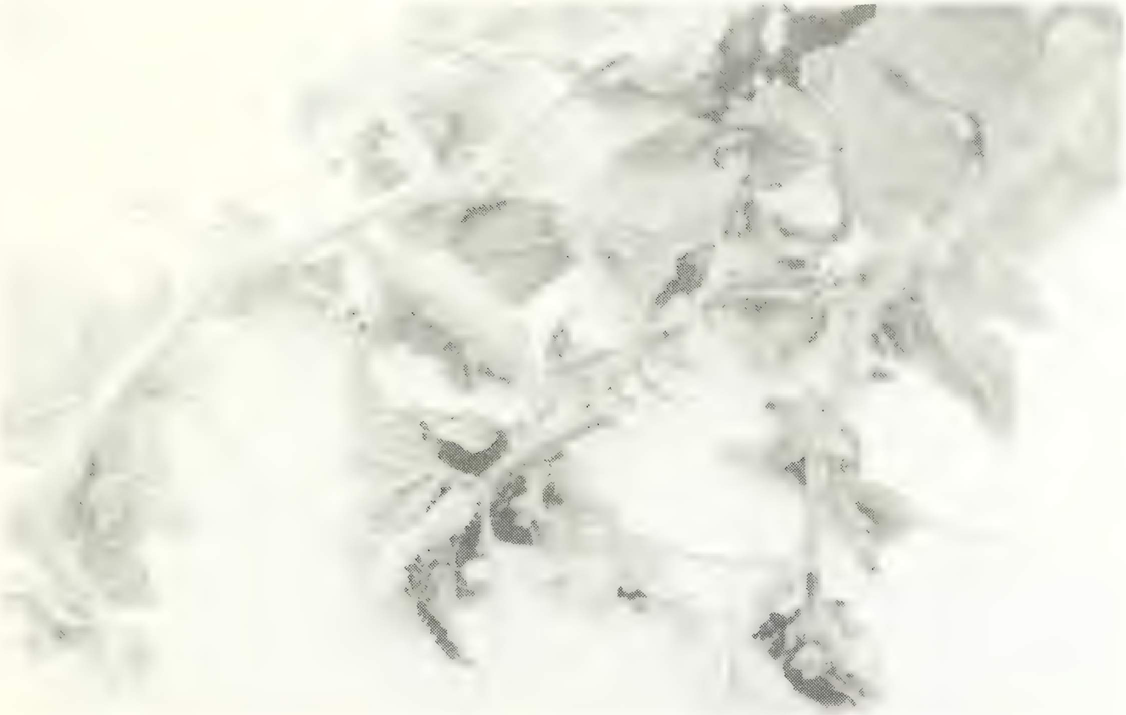


Figure 3. A typical gynoecious plant. Note the small cucumbers at each leaf axis on the vine.

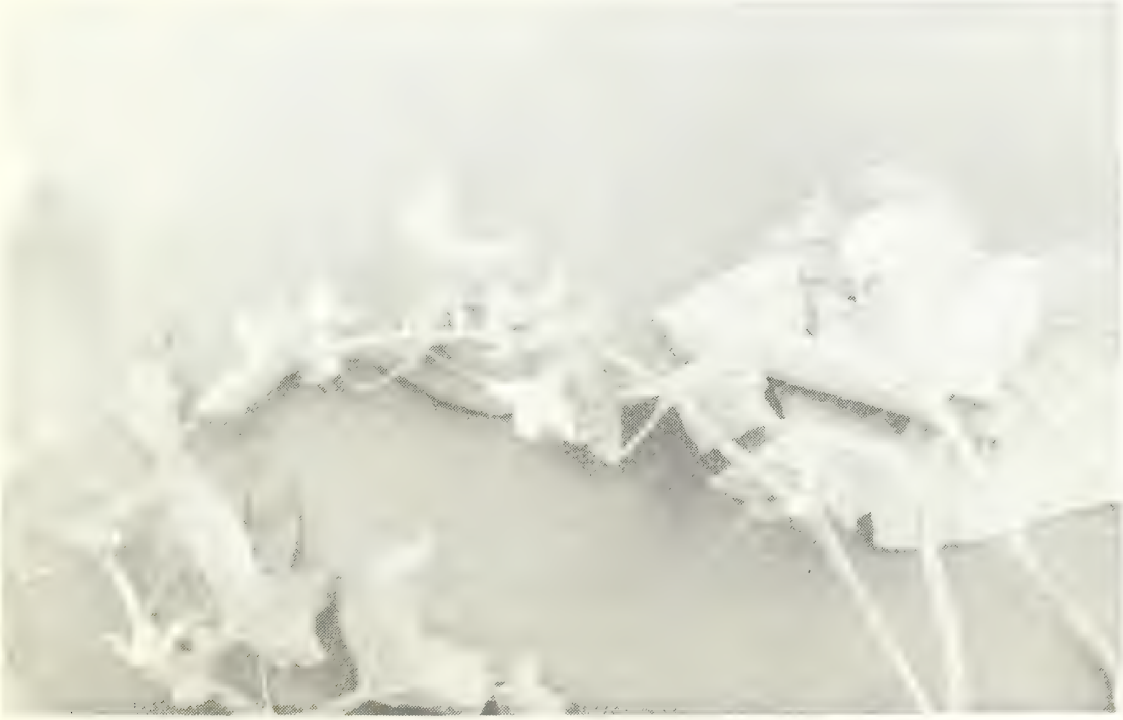


Figure 4. A typical monoecious plant. Compare to figure 3 and note the absence of cucumbers.

Table 2. The effect of plant spacing and supplementary irrigation on yield of pickling cucumbers. Data are means for two year 1969 and 1970 at Holly Springs and are in hundred weights per acre.

Grade	*Non-irrigated*				*Irrigated*			
	6"	12"	18"	Average	6"	12"	18"	Average
No. 1	19.7	19.2	17.2	18.7	39.6	42.6	29.3	37.2
No. 2	61.4	62.2	52.6	58.7	138.6	149.3	102.8	130.2
No. 3	102.0	108.2	98.0	102.7	178.2	191.8	132.2	167.4
Average total yield	203.8	285.4	233.1	240.8	396.5	426.4	293.7	372.2
LSD at 5%	Spacing = 35.3 Irrigation = 20.9							

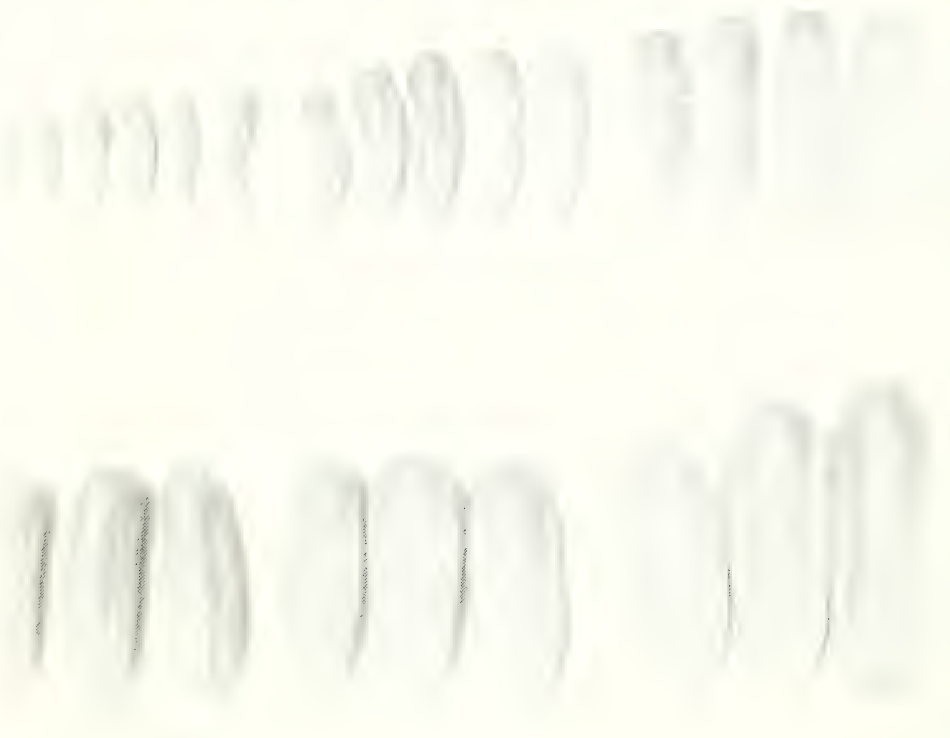


Figure 5. Cucumber grades as suggested by the Pickling Cucumber Improvement Committee. Range in size by grade is: No. 1 - up to 1-1/16 inches in diameter, No. 2 - 1-1/16 to 1-1/2 inches in diameter, No. 3 - 1-1/2 to 2 inches in diameter, No. 4 - 2 to 2-1/4 inches in diameter, No. 5 - 2-1/4 to 2-1/2 inches in diameter and No. 6 - over 2-1/2 inches in diameter.

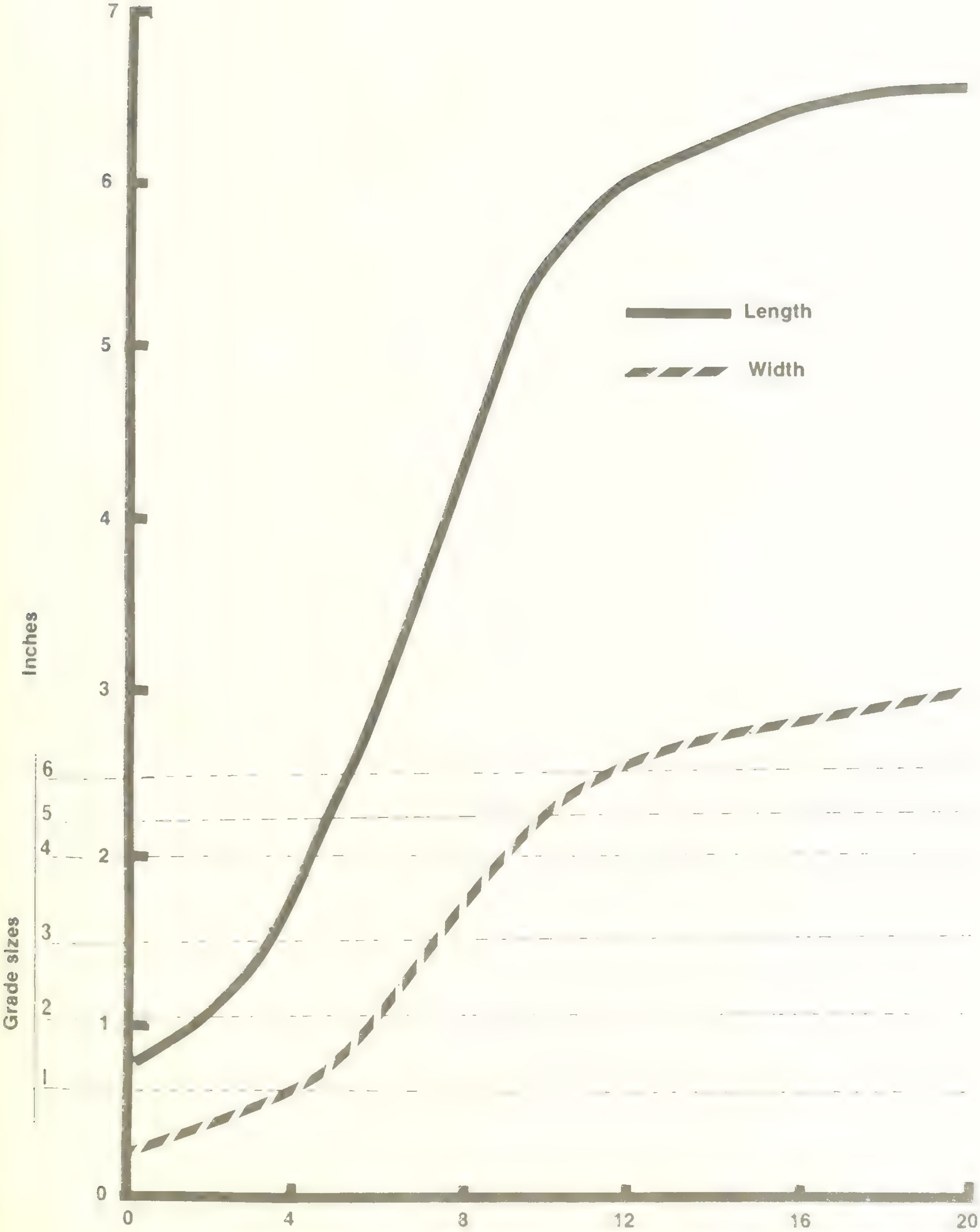


Figure 6. Rate of growth and development of the cucumber fruit.

the flower opened, the fruit had reached the maximum diameter for No. 1 fruit. One day later, it was slightly larger than the maximum size for No. 2 fruit (1-1/2 inches in diameter), and continued to increase at the rate of one grade size per day through grade 4. It required 3 days to go from grade 4 to maximum limit for grade 5. For this reason it is imperative that harvest occur at least twice weekly and preferably 3 times a week. All fruit that are of number 1 size or larger should be removed each harvest. The vines should be handled carefully to prevent excessive damage. It is better to harvest when the vines are dry, if at all possible, to reduce the spreading of foliage diseases.

An often asked question is what size should the cucumber be at harvest to produce the greatest return to the farmer. Most cucumbers produced in Mississippi are grown under contract; therefore, every effort should be made to harvest cucumbers in the size range that the processor wants. Most processors will pay a premium price for the smaller size fruit. However, labor requirements for harvest will be greater and pounds of fruit per plant will be smaller when harvesf is in the No. 1 size. If the fruit were permitted to develop to size 2 or 3, the increased pounds per plant and reduced harvest cost will more than off-set the lower value per pound of fruit.

The relationship between fruit size at harvest and the value of the production per unit area was studied at Mississippi State University. All fruit were harvested while within a specific size range, for example: in Plot 1, no fruit was permitted to get larger than 1-1/16 inches in diameter—the maximum for No. 1 fruit; in Plot 2, no fruit smaller than 1-1/16 inches in diameter were harvested and all fruit in the plot were harvested before they exceeded 1-1/2 inches in diameter, the size range for No. 2 fruit; in Plot 3, the fruit were harvested when they attained a size of 1-1/2 to 2 inches in diameter, the size range for No. 3 fruit; in Plot 4, when they were 2 to 2-1/4 inches in diameter, the size range for No. 4 fruit; in plot 5 when they were between 2-1/4 and 2-1/2 inches in diameter, the size range for No. 5 fruit; and in plot 6 the fruit were harvested after they exceeded 2-1/2 inches in diameter. The fruits in each plot were they had attained the proper size. The number of fruit per plot and the weight per plot were recorded at each harvest. The effect of fruit size at harvest on the total number of fruit produced per plant is shown in Figure 7. The number of fruit produced per plant was greatly affected by size that the fruit were allowed to attain. The longer a fruit remained on a plant, the fewer fruit that plant subsequently produced up to and including size 4.

The effect of fruit size at harvest the number of fruit per plant and on pounds produced per plant is shown Figures 7 and 8. The weight of fr harvested per plant increased rapi through size 3. When fruit size exceed No. 3, the increase in weight per fr was not sufficient to compensate for fewer fruit per plant hence the pour produced per plant was not as great when the fruit was harvested in size

Table 3. Yield of cucumber cultivars and hybrids in Mississippi. Data are averages 3 locations and 2 or more seasons.

Cultivar or Hybrid	Yield in cwt./acre			
	No. 1	No. 2	No. 3	Total
Explorer	24.9	56.8	72.8	209.6***
Ranger	24.6	54.3	72.8	201.7*
Galaxy	15.2	36.3	44.2	135.4*
Pioneer	35.1	602.	68.7	204.7
Southern Cross	30.4	65.6	93.3	234.9*
Chipper	29.1	57.6	76.0	191.8*
Piccadilly	19.6	51.8	96.7	221.2*
Model	17.4	40.1	64.8	201.7*
Ohio MR 17	22.1	68.0	80.1	219.6**
SMR 58	25.1	62.0	71.0	276.0**

*** - Average for 5 seasons and 3 locations
* - Average for 2 seasons and 3 locations
** - Average for 3 seasons and 3 locations

Table 4. The effect of fruit size at harvest on the cumulative yield and va per acre of pickling cucumbers.

All fruit harvested at size:	Three year average:		
	fruit/plant (number)	Yield per acre (pounds)	Va ac (doll
1	47.9	2,435	1,94
2	31.8	2,024	1,66
3	25.7	4,169	1,66
4	13.3	3,044	60
5	10.4	2,909	29
6	10.1	3,610	18
LSD at 5%		290	
LSD at 1%		410	

* Value per acre calculated assuming No. 1 at 8.00/cwt, No. 2 5.50/cwt, No. 3 at 4.00/cwt, No. 4 at 2.00/cwt, No. 5 at 1 cwt and No. 6. at .50/cwt.

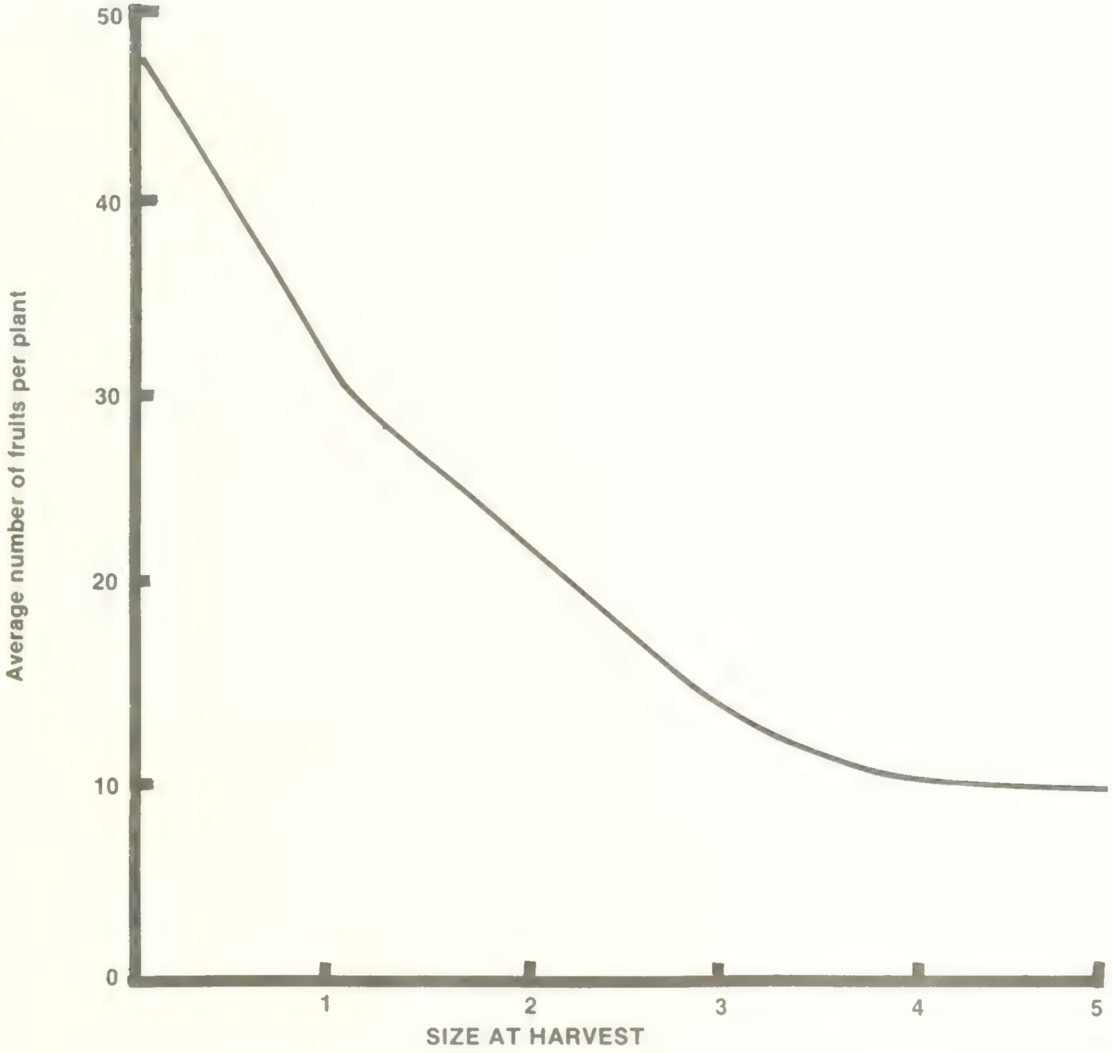


Figure 7. Effect of fruit size at harvest on the number of fruit per plant.

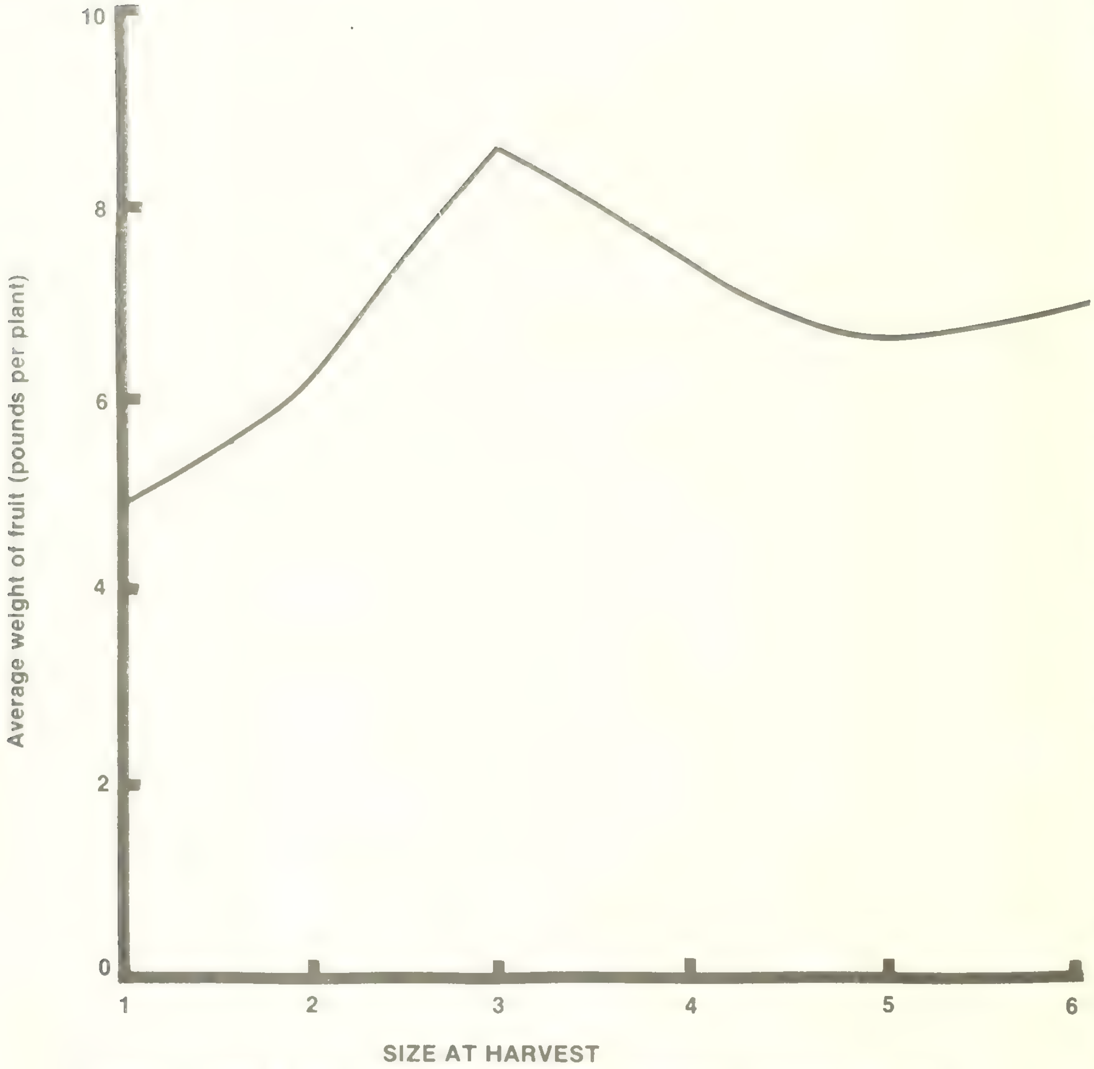


Figure 8. Effect of fruit size at harvest on the production (pounds) per plant.

ı this basis, permitting a fruit to re- ıin on the plant until it exceeded size 3 ulted in a lower yield per plant. The ta presented in Table 4 shows what uld be expected in terms of yield and lue per acre when the fruit are har- sted at a given size; however, it does t show what would be involved in ms of labor to harvest.

A study was conducted at Mis- sippi State University to determine e effect of harvest frequency on yield d value per acre. A harvest frequency every 2nd day was compared to a quency of every 4th day. Plants were amined carefully at each harvest and fruit of No. 1 size or larger were moved. The fruits were separated by ade and weighed. The percent of each ade in the total yield was determined r both harvest frequencies. The value the production per acre was termined assuming the following lues per hundred pounds of fruit of e: No. 1 - \$8.00, No. 2 - \$5.50, No. 3 - .00, No. 4 - \$2.00 and No. 5 - \$1.00.

The data are presented in Table 5. ıere was no difference in yield of No. 1 uit, however there was a highly gnificant reduction in No. 2 fruit when e harvest was on a 4 day interval. The eld of No. 3 fruit was much greater hen harvest was on a 4 day interval. ıe yield of No. 4 and No. 5 fruit counted for less than 10 percent of the roduction indicating that oroughness of harvest was very satis- ctory. There was no difference in value the total yield on a 2 day or 4 day ırvest frequency under the conditions this test; however, there was approximately twice as much investment in harvest labor for the 2 day interval compared to the 4 day interval.

Questions frequently asked by growers include: "Must I harvest every day?" "Every other day?" Twice a week?" "At what size do I harvest to realize the greatest return?" Regardless of the frequency of harvest, it must be thorough. Equally important, oversize fruits must be removed from the vine when they are discovered. Failure to do so will reduce flowering and yeild of subsequent harvest.

To determine harvest size and frequency the grower must first determine the availability and cost of labor, the potential value of the crop and how carefully he can control fruit size. Changes in value of the different fruit size grades will make corresponding changes in the value of the crop compared to that shown in Table 5. For best results the crop must be harvested at least twice weekly.

When the cucumber is harvested, it must be protected from direct sunlight and high temperatures until it is delivered to the processor. The cucumber is living plant tissue and as such respires—"burns" manufactured foods and releases water and carbon dioxide—therefore losing weight. Water is also lost through pores and breaks in the fruit skin. Exposure to sunlight and/or high temperatures increases both water loss and respiration rates and reduces the fruit weight. If it is necessary to hold the fruit for a short period, they should be placed in a cool, shaded area. They should not be refrigerated. The harvested fruit should be promptly delivered to the processor.

Insect Control

A thorough insect control program is essential for successful production of cucumbers. As soon as the seedlings begin to emerge they should be observed frequently and carefully for any indication of insect damage. At the first evidence of insects a control program should be initiated. Thorough coverage of the plant foliage is essential. Insects likely to present problems in the production of cucumbers in Mississippi include Aphids, Cucumber Beetles, Mites and Pickle Worms. The following control procedures are recommended:

Aphids—Thiodan at the rate of 1 to 1-1/2 pounds per acre, is recommended for the control of Aphids. This material may be applied as a dust or as a spray using an emulsifiable concentrate. Repeat in 5 to 6 days as needed. **Do not apply within 24 hours of harvest.**

Cucumber Beetles—Both the Striped and the Spotted Cucumber Beetles attack the plants in Mississippi. The most critical period is when the plants are emerging. The insect control program should start as soon as the plants begin to emerge. Thiodan as recommended for aphids is a good control measure. A second measure that is sometimes used is Carbaryl (Sevin) at the rate of 1 pound of active material per acre in either a dust or spray. **Do not apply within one day of harvest, do not apply Sevin any time the plants are flowering. Sevin will reduce bee**

ıble 5. The effect of frequency of harvest on the yield, grade distribution and value of cucumbers for pickles.

	Harvest Frequency					
	Every 2nd day			*Every 4th day*		
ıade size	*Pounds per acre*	*Value per acre**	*Percent of total*	*Pounds per acre**	*Value per acre*	*Percent of total*
	547.3	437.84	19.2	516.7	413.36	18.6
	1923.7	961.85	38.1	1329.7	664.85	30.0
	1882.3	752.92	37.3	2332.0	932.80	42.1
	570.2	114.04	5.0	814.9	162.98	7.4
	125.8	12.58	0.5	420.6	42.06	1.9
ıtal	5048.6	2279.23	100.0	5452.5	2216.05	100.0
S.D. at 5% - Harvest frequency				288.6		
S.D. at 1% - Harvest frequency				394.2		

Value per acre calculated assuming values of No. 1 at 8.00/cwt, No. 2 at 5.50/cwt, No. 3 at 4.00/cwt, ı. 4 at 2.00/cwt, and No. 5 at 1.00/cwt.

populations which are essential for good pollination.

Mites—Kelthane is the recommended material for the control of mites in cucumbers. Apply at the rate of one pound per acre of active material either as a spray or a dust to the plants.

Pickle Worm—The Pickle Worm is likely to be a major insect problem in fall planted cucumbers. Eggs are deposited on the young fruit and the larvae or worms bore into the developing fruits. Small holes, frequently filled with jelly-like substance, may be observed on the cucumber fruit. If the cucumber fruit is sliced open, the larva or worm will be found. Thiodan—at the same rates as suggested for Aphid control, is a good control measure for the pickle worm. **The material should not be applied within 24 hours of harvest.** The best time of application would be immediately following a harvest.

Diseases and Disease Control

The use of good seed and crop rotation are two of the most important steps in disease control. Seeds as supplied by the major seed companies are grown in the arid sections of the west and should be relatively free of disease. In addition most companies treat their seeds with protectants to reduce seedling diseases. Crop rotation is important and in planning the crop rotation such crops as watermelon, cantaloupes, and squash should not be included in the rotation because they are close relatives of the cucumber and many of the insects and diseases are common to all of the crops. These crops should not be planted on the same soil more often than once every three years. A five year rotation is better. The major diseases attacking cucumbers in Mississippi are Anthracnose, Bacterial Wilt, Downey Mildew, Angular Leaf Spot, Gummy Stem Blight, Powdery Mildew and Mosaic. The diseases are more likely to be problems in fall crops than in spring crops; however, occasionally they can be quite severe and costly even in spring crops.

Anthracnose appears as irregular, circular, brown spots, more of a rusty brown spot, on leaves and fruit. Anthracnose is controlled by the use of Maneb.

Bacterial Wilt will first become evident as segments of a vine will wilt and eventually the entire vine and plant will die. Once a vine segment wilts it is not long until the entire plant dies. The control of insects, particularly the cucumber beetles, is about the only thing that can be done to control Bacterial Wilt.

Downey Mildew first becomes evident as pale yellow spots on the leaves of the plants. These spots may enlarge and merge and the leaves eventually die. Downey Mildew is controlled by the use of Maneb.

Gummy Stem Blight appears as tan to brown spots, on the leaves, that enlarge quite rapidly. The disease is commonly accompanied by a gummy exudate, giving the term Gummy Stem Blight to the disease.

Angular Leaf Spot appears as small, irregular water soaked spots, on leav
that later turn whitish grey to brown a
drop out, leaving a shot hole appeara
on the leaves. It is most prevalent dur
and immediately following warm ra
periods. The disease usually disappe
with warm dry weather and the use
fungicides to control it is not justifie

Powdery Mildew appears as a whi
powdery mass on the leaves and
touched or brushed, it will be brush
off. It occurs during and immediate
following periods of warm, rai
weather. Maneb is the recommend
control measure.

Mosaic is a virus disease that attac
the cucumber. Leaves take on a ve
crinkled, crushed type of appearan
and there may be some intervein
chlorosis. It is a virus disease and
spread by insects, principally the aphi
Control of the aphid is the prima
method of control of Mosaic.

Maneb (Dithane M-22 or Manza
D) is the recommended fungicide for t
control of most cucumber diseases.
should be applied at the rate of 1-1/2
2 pounds of active material per acre
enough water to obtain good coverag
This would be from 30 to 40 gallons
water per acre. The use of a spreader
sticker is recommended to facilita
coverage. Coverage should be thorou
and applications should be repeated a
day intervals as long as needed.

Bulletin 802

Resistance to Twospotted Spider Mite in Cotton

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Resistance To Twospotted Spider Mite In Cotton

spotted spider mite, *Tetranychus*
ch, is a pest of cotton which is
control. Host plant resistance of-
ssible means of control if cotton
be developed which possess resis-
he mite and also have acceptable
c properties. Resistance has been
ipland cotton lines when they were
as seedlings (Schuster et al.
Within a given cotton variety there
ich variability for mite reaction,
a few plants are needed to test the
of the variety to mites. Resistance
een demonstrated in other species
pium (Leigh and Hyer, 1963;
et al. 1972b). Our preliminary tests
ated that variability existed in the
s of *G. hirsutum* L.

e number of cotton varieties and
e screened at Mississippi State,
pi to determine the degree of resis-
the twospotted spider mite in
m hirsutum L. and *G. barbadense*
vere obtained from various sources.

ods and Materials: The methods of
et al. (1972a) were used through-
ests. They are described below:

ised in these studies were obtained
olony maintained on cotton seed-
Mississippi State University. The
riginated from a field population
id demonstrated resistance to or-
sphate insecticides at the Summer-
ntation near Pickens, Mississippi
t mites were maintained in colonies
ng room on 'Henderson Bush' beans
mason sand in wooden flats (57 x 38 x 10 cm). Temperature was approximately 30°C and RH 65-75%. Plants were illuminated 18 hr each day with two 40W "plant grow" fluorescent bulbs 40 cm above the sand. One pint of bean seed sown in each flat served as a food source. A complete cycle from bean planting to mite "harvesting" occurred every 14 days.

Cotton plants were grown in the greenhouse in a mixture of sandy loam soil, mason sand and peat in a 6:1:1 ratio in flats of the above-mentioned size. A recommended rate of 3 tons of lime and 400 lb of 5-10-20 fertilizer per acre equivalent was added to this mixture for proper cotton growth (Soils Laboratory, Mississippi State University).

Seeding was accomplished by marking off 8 rows with a planting board spaced to deposit seed every 2.8 cm in the row. Plants were watered as required.

The greenhouse was cooled with an evaporative system and heated with a gas-vented heater. Daily temperatures during the summer ranged from 35°C to 40°C. Daily winter temperature was maintained above 22°C.

Test plants were infested by placing infested bean leaves (with the lower surface up) on top of the plants when they were 5 days old. The bean leaves were distributed in a contiguous layer over the entire flat. Mites were driven to the cotton from the bean leaves by the combination of sunlight and desiccation. An average of 31 mites was found on each cotton plant after 24 hours. Plants were rated for damage 25 and 45 days later.

The following scale of damage was used in

scoring each seedling: (=damage score)

1. No visible damage
2. Light feeding on true leaves evident in any degree in the form of stippling, but no evident damage to the plant such as reduced leaf growth or curling.
3. Feeding very evident; leaves mostly silvered by feeding and individual stipples obscured; leaf size reduced.
4. Ragging and/or curling of leaves; stunting of plants; defoliation evident; seventy percent of older leaf surface showing desiccated condition resulting from heavy feeding.
5. Defoliation complete.

An injury index for each cotton line was computed by summing the products of damage score, multiplied by the number of plants in each category and dividing by the total number of plants scored (normally 14). In one test (Table 5) the entire row was scored by assigning a visual average damage score to the entire row. Little damage at 25 days (injury index of 2.0) would indicate tolerance, while little damage at 45 days (injury index of 2.0) would indicate antibiosis or preference. A damage index of 4.0 or greater was considered susceptible. No data were taken at 45 days on some lines in early tests (Table 1).

The following varieties and lines were evaluated: 429 Stoneville Accession, 330 entries from the *G. hirsutum* race collection, 37 *G. barbadense* lines in the Arizona collection, 95 multiple disease resistant varieties, 27 interspecific crosses and 77 F_1 crosses between *G. hirsutum* wild races or Sea Island varieties with Upland varieties. A number of entries were evaluated more than once to verify results. The susceptible variety Stoneville 7A and the resistant variety PIMA S-2 were planted with each test to verify damage ratings.

Results: The data in Table 1 show that *G. barbadense* lines were mostly resistant (Stoneville Accession 86, 89, 192, 193, 203, 699, 700, 701), one was intermediate (SA 119) and two were susceptible (SA 15, and SA 340). The *G. hirsutum* lines were all susceptible and greatly damaged.

Screening of a number of the lines in the *G. hirsutum* race collection proved that variability exists in the wild races (Table 2). Two morrilli races (T-259, T-297), one punctatum race (T-165) seven unclassified races (T-27 316, 335, 658, 664, 668 and 706), and one latifolium race (T-489) were resistant. The only *G. barbadense* entry (T-110) was resistant. Fifty races were considered as intermediate because their injury index was near 3.00.

Two lines of South American dooryard *G. barbadense* were susceptible while all other lines were resistant (Table 3). All Egyptian *G. barbadense* and American *G. barbadense* lines were resistant. The test showed that both tolerance and antibiosis was present. Antibiosis was indicated by reduced damage indices with time. Schuster et al. (1972c) have shown that antibiosis was expressed as reduced fecundity and lengthened life cycle of the female mite.

Resistance to mite damage in interspecific crosses is shown in Table 4. Three of the hexaploids (2, 24, 25) proved to be resistant.

A number of lines being tested for boll weevil resistance were evaluated for spider mite resistance, and the results are shown in Table 5. None was resistant although five were intermediate (damage index 3.0). The Russian Sea Island-Upland cross was susceptible although Russian Sea Island (SA 699, Table 1) was resistant. However, the material tested was seven or eight generations removed from the original cross and no selection for spider mite resistance had been made.

Selections from an interspecific cross between resistant Sea Island and Upland cotton varieties (Deltapine) were tested and the results are shown in Table 6. None were found resistant. Individual plants were found to be resistant in DSI intercross 2 and four plants were selected for further resistance studies.

Multiple disease resistant breeding lines from several families did not show resistance to the twospotted spider mite (Table 7). The combination of several disease resistant factors or the absence of any one factor did not affect the susceptibility of the basic line.

Summary: A seedling screening technique was used to evaluate 994 cotton lines and varieties for resistance to the twospotted spider mite. No Upland cotton variety was found resistant. Resistance was found in *G. barbadense* lines, some lines in the *G.*

wild race collection and certain
is from interspecific crosses.

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. **Comparative mite resistance in the regional collection of obsolete varieties of** *Gossypium hirsutum.* **A few** *G. barbadense* **accessions are listed.**

	Damage index	
Common name	*25 days*	*45 days*
Nankeen Brown	3.00	3.94
Algerian Brown	4.00	3.95
Arkansas Green Lint	4.00	4.00
Extreme Okra Leaf (Nankeen)	4.00	
Marcel Leaf (Nankeen)	4.00	
Original Winesap	4.00	4.00
Intense Red	4.00	4.00
Intense Red (Okra Clean)	3.93	
Arkansas Clean Seed	4.00	
Texas Clean Seed	4.00	
Red Plant Clean Seed (no lint)	3.57	
Upright Short Fruiting Branch	4.00	4.00
Sea Island Short Sympodia	4.00	3.40
Heavy Spot Clean Yellow Anther	4.00	3.81
King 82-8 Small Heavy Spot, Cream	4.07	
Arkansas 17 (Yellow Anther)	4.00	4.00
Acala 37 (Yellow Anther)	4.00	4.00
Half and Half (Yellow Anther)	4.00	4.00
Yellow Anther	4.00	3.00
Acala 22-2	4.00	
Bawaka Cluster	4.00	4.00
Texas Short Fruiting Branch	4.00	4.00
Petal Spot	4.00	4.00
McNamara Winesap	4.00	4.00
Hite Red	4.00	
Kekchi Clean Seed	4.00	4.00
Batson Cluster	4.00	3.00
Durango Cluster	4.00	4.00
Mars Rose Cluster	4.00	4.00
H. A. 1	4.00	4.00
H. A. 2	4.00	4.00
H. A. 3	4.00	4.00
H. A. 4	4.00	4.00
H. A. 7	4.00	4.00
Sutured Apex	3.93	
Hurley Long Boll	4.00	
King No Spot (Yellow Anther)	4.04	
Black Arm Resistant x 16 (Fine)	4.00	4.00
Brown Egyptian	3.47	2.00

Table 1. Comparative mite resistance in the regional collection of obsolete varieties of *Gossypium hirsutum*. A few *G. barbadense* accessions are listed.

Stoneville accession number	*Common name*	*Damage index*	
		25 days	*45 days*
88	Sillow Red	4.00	4.00
89	Sea Island Tipless	3.75	2.00
90	Dwarf 1 Original	4.00	3.63
91	Red Dwarf Simpson	4.34	
92	Crenate	4.09	
97	Super Okra	4.00	
98	Cleveland Short Sympodia	4.00	4.28
99	Deciduous, Original	4.00	4.03
101	Upland Crinkled Dwarf Meade	4.00	4.00
102	Upland Crinkled Dwarf Triumph	4.02	
103	Rugose Indore	3.97	
105	Half and Half	4.35	
108	Acala Short Sympodia	4.00	4.00
109	Deciduous Green Leaf	4.20	
110	Dwarf 1 Nankeen	4.00	4.00
111	Short Staple Nankeen (red)	4.00	4.00
112	Tate Brown Fuzz	4.00	
113	Red Dward Harrison	4.00	4.00
116	West Texas Rough	4.00	4.00
117	Pilose	4.00	4.00
119	Sea Island 36-12-B2	4.00	3.00
124	Clarksville Long Staple	4.00	4.00
125	Brown 3-16-15 1	4.00	4.00
126	Brown 4-6-14 14	4.00	
127	Brown 7-6-14 8	4.03	
128	Clean Seed Brazil	4.00	
129-1	MSMS	4.00	
130	Chaco	4.00	4.08
131	V. Lt. Brown Lint 6-6-15	4.02	
132	*G. hirsutum*, Ware 16	4.00	
133	*G. hirsutum*, Ware 17	4.24	
135	5 Wilds 1 S. I. P. I. Selting	4.00	4.00
136	*G. hirsutum*, Ware 11	4.00	4.00
137	Ware 19, Abnormal Leaves	4.00	
139	Brown 5-6-15	4.02	
141	Red 5-6-15	4.00	
143	Mexican Naked UA 3-3	4.00	4.00
147	Crinkled Dwarf Hope	4.00	4.00
148	Big Boll Triumph UA 8-20	4.00	
149	Tucuman No. 102 UA 4-6	4.00	
150	Columbia UA 5-1	4.00	4.00
155	Hindi Weed RA 8-24	4.00	4.00
156	Person American UA 7-39	4.00	4.00
164	Nariama S. P. 88, UA 8-27	4.00	4.00
165	M. U. 3, UA 7-41	4.00	4.00
166	M. U. 8B, UA 7-44	4.00	4.00
168	U4 Bulk W4, UA 8-2	4.00	4.00
170	King, Spot UA 2-3	4.00	
171	Acala Okra, UA 2-4	4.00	4.00
173	Durango Cluster, UA 2-6	4.00	4.00
175	Meade, UA 2-8	3.97	

1 Comparative mite resistance in the regional collection of obsolete varieties of *Gossypium hirsutum*. A few *G. barbadense* accessions are listed.

Common name	Damage index 25 days	Damage index 45 days
Texas Clean Seed, UA 8-10	4.00	
Arkansas Clean Seed, UA 8-12	4.00	4.00
Upland, UA 7-1	4.00	
UA 7-6	4.00	4.00
Felistana, UA 7-18	4 00	4.00
UA 7-20	4.00	4.00
UA 7-33, Hirsutum 111	4.00	4.00
Sea Island Seaberry	3.23	2.00
Sea Island Tzrv. (Glabrous)	3.11	2.00
Beasley's Hybrid 49-0-4	4.00	4.08
Marshall	4.00	4.00
G. barbadense Tashkent	3.00	2.00
G. hirsutum Tashkent	4.00	4.00
Neely 531C Small Boll	4.00	
Laffery Brown Lint	4.00	4.00
K-308 (Navrotsky)	4.00	4.00
1113	4.00	4.00
K-2102, Var. 182 Ak-Djura	4.00	4.00
K-2264	4.00	4.00
K-3112, 915 Pioneer	4.00	4.00
K-3129, 8517	4.00	4.00
Kekchi	4.00	4.00
Hopi Moencopi	4.00	4.00
Lone Star	4.00	4.00
Paris Big Boll	4.00	4.00
Patty's Toole	4.00	4.00
Sikes 38-6	4.02	
Tidewater 4	4.00	4.00
Tidewater (Seabrooks)	4.00	
Wannamaker's Dixie Triumph	4.00	
Texas Special	4.00	
Rowden 2	4.00	
Rowden 3	4.00	
Rowden 3-7	4.00	4.00
Rowden 13	4.00	
Stoneville 2B (Original)	4.00	4.00
Delfos (Original)	4.00	4.00
Ambassador (4 B6)	4.00	4.00
Stoneville 5A	4.00	4.00
Stoneville 2C (Original)	4.02	
Washington (719-286)	4.00	
Coker 100 Str. 9	4.00	
Bobshaw 1	4.00	
Bobshaw 1-819	4.00	
Bobshaw 33	4.00	
Bobshaw 948	3.64	
Bobshaw 0339	4.00	
Bobshaw 31	4.00	
Rebdel	4.00	4.00
Smith's 78	4.00	
Stoneville 20	4.03	
Uganda B-31	4.00	4.00
Acala 5675	4.00	

Table 1. Comparative mite resistance in the regional collection of obsolete varieties of *Gossypium hirsutum*. **A few** *G. barbadense* **accessions are listed.**

Stoneville accession number	*Common name*	*Damage index* 25 days	45 days
336	Coker 33-12	4.00	4.00
337	Delfos 719	4.05	
340	Seaberry Sea Island	4.00	
342	Trice 2A	4.00	4.00
343	Cobal T16	4.00	4.00
344	Cobal T11	4.00	3.90
347	Pandora	4.00	4.00
348	Watson's Dixie Triumph	4.00	
351	Rowden 40-5-3-1-2	3.89	
353	Rowden 2088	4.00	
354	Stoneville 4B	4.00	4.00
356	Farm Relief	4.00	
357	Mexican Big Boll	3.00	
358	Mexican	4.00	4.00
360	Florida Green Seed	4.00	3.92
365	Hart	4.08	
366	Piedmont Cleveland 2-1	4.00	
368	Delfos A_2C_3	4.00	
369	D & PL 10-1	4.17	
372	D & PL 4-8	4.13	
373	Express 432	4.00	
378	Stoneville x Hopi 11-1-4	4.00	4.00
383	Roxe 2-4-2-5-4	3.97	
384	Uganda 4 Pl. 1	4.00	3.95
385	Uganda 4 Pl. 3	4.00	4.00
386	Wacona Pl. 1	4.00	
387	Wacona Pl. 2	4.00	
388	Punjab	4.00	4.00
389	Acala 911 Pl. 1	4.00	3.84
391	Missdel 6 Pl. 1	4.00	
394	Selection 21 Pl. 2	4.01	
395	Deltatype Webber	4.00	3.85
396	Super Round	4.00	
398	Okra Round	4.00	4.00
400	Carter Long Staple	4.00	4.00
402	Super 7	4.00	3.88
404	AHA x C 100W x C 100W	4.00	4.00
405	Ewing Long Staple x Tidewater	4.00	4.00
408	Sealand 391	4.00	4.00
409	Tidewater E 372-4	4.00	4.00
410	Sealand 472	4.00	4.00
411	Sealand 542	4.00	4.00
412	Rowden 40-80-8	3.95	
415	Deltapine 11A B1-5	4.02	
417	Deltapine 11A B6-3	4.17	
420	Deltapine 11A B10-20	4.00	
421	Mexican Acala Clean Seed	4.00	4.00
422	King 82	4.00	4.00
424	Hopi M5-11	4.00	4.00
426	Triple Hallmark Sea Island	4.00	4.00
427	Hartsville	4.00	4.00
428	Carver 8 Red Plant	4.00	4.00
429	Columbia	4.06	

Comparative mite resistance in the regional collection of obsolete varieties of *Gossypium hirsutum*. A few *G. barbadense* accessions are listed.

Common name	Damage index 25 days	 45 days
Acala x Hopi 302-22	4.00	
Acala x Hopi 76-18-13	4.00	
Acala x Hopi 76-18-8	4.00	
Acala x Hopi 76-15-5	4.00	
CB 2046	4.00	4.00
Stoneville 014	4.00	
Stoneville 2	4.02	
Stoneville A	3.92	
Stoneville 5B	4.00	
CB 2047	4.00	4.00
Acala Okra	4.00	
Acala N 28-5	4.00	4.00
Acala 1517 Wilt	4.00	
Arkansas 17	4.00	
Coker 100 Staple	4.00	
Coker 100 Wilt	4.00	4.00
Delfos 4	4.00	4.00
Delfos 651	4.00	
Delfos 4-65	4.00	
Deltapine A	4.00	
Deltapine 12	4.00	4.00
Deltapine 14 (44-51)	4.00	4.00
Deltapine 15	4.07	
D & PL 45-867	4.00	4.00
AHA 6-1-4	4.00	
Empire P 45-3	4.00	4.00
Miller	4.00	
Washington	3.73	
Wilds 15	4.00	4.00
Wilds 18	3.83	
Green Brown 7(Nankeen)	4.00	4.00
Brown 6 (Texas Rust)	4.00	
Higginbotham Brown Lint #9	4.00	
Green Lint 4	4.00	
Trice, no spot	4.00	
King, Spot	4.00	
C.A. 119-4/14 (Stormproof)	4.00	
C.A. 122 Early (Stormproof)	4.00	
C.A. 119-1/29 (Stormproof)	4.00	
C.A. 119-4/17 (Stormproof)	4.00	
Rowden, Malone	3.77	
Ducona Cluster	4.03	
Jackson 1	4.00	
Cambodia 4	4.00	3.95
Uganda 8-9	4.00	
Synthetic Line 1-7-1 (No Lint)	4.00	3.00
D.A.F. 11 (Apical Furrow)	4.00	
Kasch 3 (Apical Furrow)	4.00	4.00
Ferguson 406	4.00	4.00

ible 1. Comparative mite resistance in the regional collection of obsolete varieties of *Gossypium hirsutum*. A few *G. barbadense* accessions are listed.

oneville cession mber	*Common name*	*Damage index* 25 days	45 days
	Locket 140-46	4.00	4.00
	Harper D.D. Rowden	4.00	3.54
	Northern Star	4.00	
	Mebane, Watson	4.00	
	Acala 111, Rogers	4.00	
	Mebane 140	4.00	4.00
	Paymaster 54	4.00	4.00
	Rowden 41 B, Bryant	4.00	
	Lankart 57	4.00	4.00
	Dentex 74-2	3.91	
	Burnett	4.00	
	Crumpled	4.00	
	Coker 100(High Lint)	4.05	
	D & PL 11A T 154-2	4.00	
	Stoneville 5, T 196-4	4.00	
	Stoneville 5, T196-9	3.62	
	Wilds 34-4 (411), T87-8	3.44	
	Stoneville 5A, T219-6	4.00	
	Tidewater 29	4.00	
	Greer Wichita, T170-4	4.00	
	Wilds 34-4 (411), T82-2	4.00	
	Wilds 34-4 (411), T85-2	4.00	
	Protzman (968)	3.98	
	P.K. 15-M-3	3.89	
	DeRidder Red Leaf, T155-3	4.19	
	DeRrdder Red Leaf, T156-4	4.00	
	West Texas Rough T162-7	4.00	
	Florida 1377 T167-10	4.06	
	West Texas Rough, T162-7	3.98	
	G. hirsutum, CB 2472, Turkey	4.00	4.00
	G. hirsutum, CB 2479, Turkey	4.00	
	G. hirsutum, CB 2480, Turkey	3.72	
	G. hirsutum, CB 2482, Turkey	4.00	4.00
	G. hirsutum, CB 2483, Turkey	4.00	4.00
	G. hirsutum, CB 2489, Turkey	4.00	4.00
	G. hirsutum, CB 2490, Turkey	4.00	4.00
	G. hirsutum, CB 2492, Turkey	4.00	4.00
	CB 2493	4.00	4.00
	CB 2519	4.00	4.00
	CB 2717	4.00	4.00
	CB 2525	4.00	4.00
	CB 2526	4.00	4.00
	CB 2527	4.00	4.00
	CB 2528	4.00	4.00
	CB 2536	4.00	4.00
	D.E. Ewing Long Staple x Tidewater	3.46	
	Sealand 1	4.00	3.96
	Sealand 2	4.00	4.00
	Sealand 7, Yellow Flower	4.00	4.00
	Sealand 7, White Flower	4.00	4.00

[illegible] Comparative mite resistance in the regional collection of obsolete varieties of *Gossypium hirsutum*. A few *G. barbadense* accessions included.

Common name	Damage index 25 days	45 days
[illegible] land 883	4.00	
G. hirsutum, CB 2628	4.00	4 00
G. hirsutum, CB 2630	4.00	4 00
G. hirsutum, CB 2544	4.00	
G. hirsutum, CB 2545, India	4.00	
G. hirsutum, CB 2554	4.03	
G. hirsutum, CB 2555, India	4.00	
G. hirsutum, CB 2548, India	4.00	
G. hirsutum, CB 2550	3.47	
G. hirsutum, CB 2678, Turkey	4.00	
G. hirsutum, CB 2678, Turkey	4.00	
G. hirsutum, CB 2679, Turkey	4.00	
G. hirsutum, CB 2679, Turkey	4.00	
G. hirsutum, CB 2679, Turkey	4.00	
Lintsing Stoneville	4.00	
Lintsing SZE TZE 4B	4.02	
[illegible] R I O Nan C1)	3.95	
Smooth Boll 1	4 00	
[illegible]sian Sea Island	2.00	
Puerto Rico Reg. Sea Island	2.00	
[illegible] Ordinary	2.00	
Arkansas 2	4.00	
Arkansas 3	4.00	
Arkansas 6	4.00	
Arkansas 9	4.02	
Arkansas 10	4.00	
Arkansas 11	4.06	
Arkansas 12	4.00	
Arkansas 13	4.00	
Arkansas 16	4.00	
Arkansas 17	4.06	
Arkansas 19	4.00	
Arkansas 20	3.00	
Arkansas 21	4.00	
Arkansas 22	4.00	
Arkansas 23	4.02	
Arkansas 25	4.04	
McNamara Okra Leaf (Ark. 26)	4.05	
Smooth Boll 1 41-3-3	4.24	
	4.00	
Mexican 68	4.00	
Mexican 74	4.00	
Mexican 121	4.00	
Cook 307 2-1-8-11-2	4.00	
Cook 144-30	4.00	
White Gold 5	4.02	
White Gold Wilt	4.00	

1. **Comparative mite resistance in the regional collection of obsolete varieties of *Gossypium hirsutum*. A few *G. barbadense* accessions are listed.**

	Damage index	
Common name	*25 days*	*45 days*
Deltatype Webber	4.00	
Dixie Triumph 83	4.00	
Station Miller	4.00	
Deltapine 8-829	4.00	
Deltapine 14	4.00	
Stoneville 3	4.00	
Ambassador	4.03	
Delfos Washington	4.00	
Missdel	4.00	
Lightning Express	4.00	
Wilds 5	4.00	
Miller 919	4.00	
Rucker	4.00	
Acala Texas	4.00	
New Boykin	4.00	
Mebane	4.00	
Sea Island x Spears Green	4.00	
Spears Green	4.02	
Beasley's Hybrid 9-D-2	3.48	
Beasley's Hybrid 11-A-11	4.00	
PI 1944833 KP 28 *G. hirsutum*	4.00	
PI 194831 B181 *G. hirsutum*	4.00	
PI 194832 BP52, MB2 *G. hirsutum*	4.00	
Meade 14-2	4.00	
Acala W 29-6	4.00	
Kekchi 7-8	4.00	
Acala 1517-40	3.00	
PI 194852 28 C3	3.38	
Acala 4067-5	4.11	
PI 194846 53 D7	4.00	
PI 194850 CI	4.11	
PI 194848 S. A. 3	3.00	
PI 194847, C6, Greece	4.00	
PI 194853, 2 x 4 Greece	4.00	
PI 194849 53 D4	4.00	
PI 194845, 49 D2	3.77	
PI 194851, 29 x 2 Greece	4.00	
PI 194844, 25 D9 Greece	4.00	
Cup Leaf	4.00	
Auburn 56	4.00	
Auburn 81-16	4.00	
All-In-One	4.00	
Andrews	4.00	
Bobshaw 1A	4.00	
Bobshaw 99	4.00	
Bobshaw High Lenter	4.00	
HiBred	4.00	
Plains	4.00	
Stoneville 3202	4.00	

omparative mite resistance in the regional collection of obsolete arieties of *Gossypium hirsutum*. A few *G. barbadense* accessions sted.

Common name	*Damage index*	
	25 days	*45 days*
T-89	4.00	
Stardel	4.00	
Stoneville 7	4.00	
Spears Upland Early Long Staple	4.00	
Columbian	4.00	
Glandless Boll	4.00	
A 2106	4.00	
Saenz Pena 61	4.00	
Saenz Pena 85	4.00	
Blightmaster	4.00	
Acala, Texacala	4.00	
Q. C. Acala	4.00	
Santan Acala 25	4.00	
C.B. 3424	4.00	
Kekchi 4	4.00	
Austin	4.00	

le 2. **Comparative mite resistance in wild races of** *Gossypium hirsutum* **and** ***G. barbadense.***

as race mber	*Race name*	*Geographic origin*	*Damage index*	
			25 days	*45 days*
1	palmeri	Guerrero, Mexico	3.00	3.00
2	latifolium	Guerrero, Mexico	4.00	3.75
3	latifolium	Guerrero, Mexico	4.00	4.00
4	latifolium	Guerrero, Mexico	4.00	3.92
5	palmeri	Guerrero, Mexico	3.00	3.00
6	latifolium	Pueblo, Mexico	4.00	4.00
7	latifolium	Pueblo, Mexico	4.00	4.00
9	palmeri	Oaxaca, Mexico	4.00	3.79
10*		Oaxaca, Mexico	4.00	3.90
14	richmondi	Oaxaca, Mexico	4.00	3.36
15*		Oaxaca, Mexico	4.00	3.40
16	latifolium	Chiapas, Mexico	4.00	4.00
17	latifolium	Chiapas, Mexico	4.00	4.00
19	richmondi	Chiapas, Mexico	4.00	4.00
21	latifolium	Chiapas, Mexico	4.00	4.00
22	latifolium	Chiapas, Mexico	4.00	3.79
24	latifolium		4.00	4.00
25	punctatum	Chiapas, Mexico	4.00	3.70
27	punctatum	Chiapas, Mexico	4.00	3.70
28	punctatum	Chiapas, Mexico	4.00	3.46
29	punctatum	Chiapas, Mexico	4.00	4.00
30	latifolium	Chiapas, Mexico	4.00	4.00

e 2. Comparative mite resistance in wild races of *Gossypium hirsutum* and *G. barbadense*.

ıs race ber	*Race name*	*Geographic origin*	*Damage index*	
			25 days	*45 days*
	latifolium	Chiapas, Mexico	4.00	3.77
	latifolium	Chiapas, Mexico	4.00	3.15
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	punctatum	Chiapas, Mexico	4.00	4.00
	punctatum	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	3.85
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Chiapas, Mexico	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	3.93
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	3.50
	latifolium	Guatemala	4.00	3.57
	latifolium	Guatemala	4.00	3.92
	latifolium	Guatemala	4.00	3.60
	latifolium	Guatemala	4.00	3.85
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	3.75
	latifolium	Guatemala	4.00	3.78
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	3.83
	latifolium	Guatemala	4.00	3.90
	latifolium	Guatemala	4.00	3.08
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00

. Comparative mite resistance in wild races of *Gossypium hirsutum* and *G. barbadense.*

ce	Race name	Geographic origin	Damage index 25 days	Damage index 45 days
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	3.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	3.85
	latifolium	Guatemala	4.00	4.00
	latifolium	Oaxaca, Mexico	4.00	3.93
	latifolium	Oaxaca, Mexico	4.00	4.00
	commercial variety	Guatemala	3.00	2.09
	marie-galante	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	3.50
	latifolium	Guatemala	4.00	4.00
	punctatum	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Oaxaca, Mexico	4.00	4.00
	latifolium	Guatemala	3.00	3.00
	latifolium	Guatemala	4.00	3.80
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	3.13
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	3.00
	morrilli	Oaxaca, Mexico	4.00	3.00
	morrilli	Oaxaca, Mexico	4.00	3.00
	morrilli	Oaxaca, Mexico	4.00	3.00
		Oaxaca, Mexico	4.00	3.44
	latifolium	Guatemala	4.00	3.67
	marie-galante	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	punctatum	Guatemala	3.00	3.00
	latifolium	Oaxaca, Mexico	4.00	4.00
		Guatemala	4.00	4.00
		El Salvador	4.00	4.00
		Guatemala	4.00	4.00
		Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	4.00
	latifolium	Guatemala	4.00	3.69
	latifolium	Guatemala	4.00	3.75
	latifolium	Guatemala	4.00	4.00
	latifolium	Oaxaca, Mexico	4.00	3.00
	latifolium	Guerrero, Mexico	4.00	3.92
	latifolium	Guatemala	4.00	4.00
	punctatum	Guatemala	4.00	3.00
	latifolium	Guatemala	4.00	3.77
	punctatum	Guatemala	3.00	2.20
	latifolium	Guatemala	4.00	3.86
	morrilli	Oaxaca, Mexico	4.00	3.40

Table 2. Comparative mite resistance in wild races of *Gossypium hirsutu* and *G. barbadense.*

Texas race number	*Race name*	*Geographic origin*	*Damage index*	
			25 days	*45 days*
173	latifolium	Guatemala	4.00	4.00
174	latifolium	Guatemala	4.00	4.00
175	latifolium	Guatemala	4.00	4.00
177	latifolium	Guatemala	4.00	4.00
178	latifolium	Guatemala	4.00	3.90
180	latifolium	Guatemala	4.00	4.00
181	latifolium	Oaxaca, Mexico	4.00	4.00
182	latifolium	Guerrero, Mexico	4.00	3.85
183	latifolium	Guerrero, Mexico	4.00	3.38
186	latifolium	Guatemala	4.00	4.00
187	punctatum	Guatemala	4.00	3.67
188	latifolium	Guatemala	4.00	3.58
192	morrilli	Oaxaca, Mexico	4.00	4.00
195	latifolium	El Salvador	4.00	4.00
196	latifolium	El Salvador	4.00	3.31
197	latifolium	Guatemala	4.00	3.93
198	latifolium	Guatemala	4.00	4.00
199	latifolium	Guatemala	4.00	4.00
200	latifolium	Guatemala	4.00	3.46
201	latifolium	Guatemala	4.00	3.89
203	latifolium	Oaxaca, Mexico	4.00	4.00
204	latifolium	Oaxaca, Mexico	4.00	4.00
205	latifolium	Guerrero, Mexico	4.00	3.93
206	latifolium	Guerrero, Mexico	4.00	4.00
208	latifolium	Guatemala	4.00	4.00
209	latifolium	Guatemala	4.00	4.00
212	latifolium	Oaxaca, Mexico	4.00	3.88
213	latifolium	El Salvador	4.00	4.00
214	latifolium	El Salvador	4.00	4.00
215	latifolium	El Salvador	4.00	3.64
216	latifolium	El Salvador	4.00	3.50
217	latifolium	Guatemala	4.00	4.00
218	latifolium	Guatemala	4.00	3.29
219	latifolium	Guatemala	4.00	3.21
220	latifolium	Guatemala	4.00	3.93
221	latifolium	Guatemala	4.00	3.71
222	latifolium	Guatemala	4.00	4.00
223	latifolium	Guatemala	4.00	4.00
224	latifolium	Oaxaca, Mexico	4.00	2.71
225	latifolium	Guerrero, Mexico	4.00	4.00
226	latifolium	Guerrero, Mexico	4.00	4.00
227	latifolium	El Salvador	4.00	4.00
228	latifolium	Guatemala	4.00	3.86
229	latifolium	Guatemala	4.00	3.86
231	punctatum	Guatemala	4.00	4.00
232	latifolium	Oaxaca, Mexico	4.00	3.73
233	latifolium	Guatemala	4.00	3.90
234	latifolium	El Salvador	4.00	4.00
235	latifolium	El Salvador	4.00	4.00
236	latifolium	Guatemala	4.00	4.00
237	latifolium	Guatemala	4.00	4.00
238	latifolium	Guatemala	4.00	4.00

2 mparative mite resistance in wild races of *Gossypium hirsutum* *adense.*

	Race name	*Geographic origin*	*Damage index 25 days*	*Damage index 45 days*
	[illegible]	Guatemala	4.00	4.00
	[illegible]	Guatemala	4.00	4.00
	olium	Guatemala	4.00	4.00
	olium	Oaxaca, Mexico	4.00	3.93
	[illegible]	Oaxaca, Mexico	4.00	4.00
	folium	Guerrero, Mexico	4.00	4.00
	-galante	Guerrero, Mexico	4.00	4.00
	[illegible]	Guatemala	4.00	4.00
	ium	Guatemala	4.00	4.00
	ium	Guatemala	4.00	3.29
	atum	Guatemala	4.00	3.00
	[illegible]	Oaxaca, Mexico	4.00	4.00
	[illegible]	Oaxaca, Mexico	4.00	3.78
	[illegible]	Oaxaca, Mexico	3.75	2.00
	morrilli	Oaxaca, Mexico	4.00	3.00
	[illegible]	Oaxaca, Mexico	4.00	3.67
	morrilli	Oaxaca, Mexico	4.00	3.00
		Guerrero, Mexico	4.00	3.00
		Guerrero, Mexico	4.00	2.00
	morrilli	Oaxaca, Mexico	4.00	2.38
	mondi	Oaxaca, Mexico	4.00	3.25
3	morrilli	Oaxaca, Mexico	4.00	4.00
3	morrilli	Oaxaca, Mexico	4.00	3.44
4	folium	Oaxaca, Mexico	4.00	4.00
7	rrilli	Oaxaca, Mexico	4.00	2.00
1	morrilli	Oaxaca, Mexico	4.00	3.00
2*		Oaxaca, Mexico	4.00	2.91
3	lmeri	Oaxaca, Mexico	3.42	3.00
4*		Guerrero, Mexico	4.00	3.00
6*		Guerrero, Mexico	4.00	3.00
7*		Guerrero, Mexico	4.00	3.00
8*		Guerrero, Mexico	4.00	3.00
9*		Oaxaca, Mexico	4.00	3.00
10*		Guerrero, Mexico	4.00	3.00
11*		Guerrero, Mexico	3.71	4.00
12*		Guerrero, Mexico	4.00	2.89
13*		Guerrero, Mexico	4.00	3.00
14*		Guerrero, Mexico	4.00	3.50
16*		Guerrero, Mexico	3.90	2.00
18*		Guerrero, Mexico	4.00	4.00
20*		Guerrero, Mexico	4.00	3.57
21*		Guerrero, Mexico	4.00	3.00
23*		Guerrero, Mexico	4.00	3.14
24*		Guerrero, Mexico	4.00	3.50
25*		Guerrero, Mexico	4.00	4.00
27*		Guerrero, Mexico	4.00	4.00
28*		Oaxaca, Mexico	4.00	4.00
30*		Guerrero, Mexico	4.00	3.00
31*		Guerrero, Mexico	4.00	3.00
32*		Guerrero, Mexico	4.00	3.00
33*		Guerrero, Mexico	4.00	3.00
35*		Guerrero, Mexico	4.00	2.00

able 2. Comparative mite resistance in wild races of *Gossypium hirsu* and *G. barbadense*.

exas race umber	Race name	Geographic origin	Damage index 25 days	45 days
337*		Oaxaca, Mexico	4.00	3.00
340*		Guerrero, Mexico	4.00	3.67
341*		Guerrero, Mexico	4.00	3.71
342*		Guerrero, Mexico	4.00	3.75
344*		Oaxaca, Mexico	4.00	3.78
345*		Guerrero, Mexico	4.00	3.57
375	latifolium	Paraguay	4.00	4.00
377	latifolium	Oaxaca, Mexico	4.00	4.00
378	latifolium	Oaxaca, Mexico	4.00	4.00
397*		Hopi M5-4-13-1	4.00	4.00
399*		Hopi M6-14-1-3	4.00	4.00
404*		Hopi N. Mexico 1239	4.00	4.00
406*		Hopi M6-14-10-2	4.00	4.00
408*		Hopi Sac. AB-4	4.00	4.00
409*		Hopi Sacaton	4.00	4.00
460*		Oaxaca, Mexico	4.00	3.75
461	richmondi	Oaxaca, Mexico	4.00	3.92
462	richmondi	Oaxaca, Mexico	4.00	3.00
463	richmondi		4.00	4.00
465	latifolium		4.00	3.00
466	latifolium		4.00	3.64
467*		Chiapas, Mexico	4.00	4.00
469	latifolium		4.00	4.00
473	punctatum	Guatemala	4.00	3.00
481	punctatum	Yucatan, Mexico	3.00	3.00
487	punctatum	Yucatan, Mexico	4.00	2.83
488	punctatum	Yucatan, Mexico	4.00	3.00
489	latifolium	Yucatan, Mexico	4.00	2.00
490	latifolium	Yucatan, Mexico	4.00	3.00
492	latifolium	Yucatan, Mexico	4.00	3.00
495	punctatum		3.00	3.00
497	latifolium	Chiapas, Mexico	4.00	3.00
499	latifolium	Yucatan, Mexico	4.00	4.00
503	latifolium	Mexico	4.00	4.00
595*			4.00	4.00
596*			4.00	4.00
597*			4.00	4.00
600*			4.00	3.29
604*		Pueblo, Mexico	4.00	3.00
605*			4.00	3.00
606*			4.00	3.00
607*			4.00	3.00
609*			4.00	4.00
611*			4.00	4.00
612*			4.00	4.00
615*			4.00	4.00
619*			4.00	4.00
620*			4.00	4.00
621*			4.00	4.00
622*			4.00	4.00
623*			4.00	4.00
624*			4.00	4.00

2. **Comparative mite resistance in wild races of** *Gossypium hirsutum* **and** *G. barbadense.*

race er	Race name	Geographic origin	Damage index	
			25 days	45 days
7*		Guatemala	4.00	4.00
8*		Guatemala	4.00	3.00
3*		Guatemala	4.00	4.00
4*		Guatemala	4.00	4.00
5*		Guatemala	4.00	4.00
6*		Guatemala	4.00	4.00
7*		Guatemala	4.00	4.00
8*		Guatemala	4.00	4.00
9*		Guatemala	4.00	4.00
40*		Guatemala	4.00	4.00
41*		Guatemala	4.00	4.00
42*		Guatemala	4.00	4.00
43*		Guatemala	4.00	4.00
44*		Guatemala	4.00	4.00
45*		Guatemala	4.00	4.00
46*		Guatemala	4.00	4.00
47*		Guatemala	4.00	4.00
49*		Guatemala	4.00	4.00
50*		Guatemala	4.00	4.00
55*			3.00	3.00
58*			3.00	2.00
63*		Yucatan, Mexico	4.00	4.00
64*		Yucatan, Mexico	4.00	2.00
65*			4.00	4.00
68*		Yucatan, Mexico	4.00	2.00
74		Yucatan, Mexico	4.00	4.00
75*			4.00	4.00
77*			3.28	3.00
78*			4.00	3.00
79*			4.00	4.00
681*			1.00	3.00
682*			3.00	4.00
683*			3.92	3.17
684*			4.00	4.00
685*			4.00	4.00
686*			4.00	4.00
701*			3.07	2.64
702*			4.00	4.00
703*			4.00	4.00
705*			4.00	4.00
706*			3.75	2.00
709*		Nicaragua	4.00	4.00
711*			4.00	4.00
733*		Mexico	4.00	2.20
735*		Mexico	4.00	4.00
738*			4.00	4.00
743*		Guatemala	4.00	3.00

***Species and/or race classification is unknown.**
***G. barbadense.*

Table 3. South American dooryard, Sea Island and American *Gossypium barbadense* lines screened for resistance to the twospotted spider mite.

Arizona cotton research center number	*Common name and/or origin*	*Damage index*	
		25 days	*45 days*
	South American Dooryard		
K 4	Guatemala	2.00	2.00
K 6	Guatemala	2.00	2.00
K 8	Guatemala	2.00	2.00
K 23	British Honduras	2.00	2.00
K 37	Haiti	2.00	2.00
K 44	Guadalupe	3.80	2.80
K 60	Colombia	2.00	2.00
K 63	Colombia	4.00	4.00
K 65	Ecuador	4.00	2.50
K 75	Peru	3.20	2.00
K 83	Peru	3.00	2.00
K 93	Peru	3.00	2.00
K 97	Peru	2.00	2.00
K 101	Bolivia	3.00	2.00
K 103	Bolivia	2.00	2.00
K 136	Argentina (Mataco)	2.00	2.00
K 162	Argentina (Diaguita)	2.20	2.30
K 173	Argentina (Guarani)	2.00	
K 195	Brazil	2.00	2.00
K 196	Brazil	2.20	2.00
	Sea Island		
K 247	S. I. Barbados	3.00	2.00
K 255	S.I. 3612 B 2	2.80	2.00
K 256	S.I. 12 B 2	2.00	2.00
K 266	S.I. Crinkle	200	2.00
K 276	Fiji S.I.	2.30	2.00
	Egyptian		
K 249	Bahtim 163	2.00	2.00
K 250	Bahtim 185	2.40	2.00
K 261	K3130 Maarad	2.10	2.00
K 262	K3104 Maarad	3.00	2.00
	Other Selected Lines		
	Pima S-4, glanded	2.00	2.00
	Pima S-4, glandless	2.00	2.00
	Z-101*	2.00	2.00
	B65 Togo	2.00	2.00
	Pima S-2	2.00	2.00
	Pima S-3	2.00	2.00
	(Pima S-2 X $R_1 R_1$ RdRd)F_2 ⊗	4.00	2.74
	(Pima S-2 X $bw_1 bw_1 bw_2 bw_2$)F_2 ⊗	3.00	2.00

***Doubled haploid of *G. barbadense* from Puerto Rico.**

e 4. **Resistance of selected interspecific *Gossypium* crosses to damage by the twospotted spider mite. ***

y	age index 25 days
3rd generation BC [(Coastland 401 x M8) x M8] G. *barbadense* Cyt.; 264 O.P.	4.00
6X G. *hirsutum* x G. *sturtianum*	3.00 * *
BC$_5$ to M8 + S$_8$) x B-line of [(G. *arborium* x G. *thurberi*)] 4X x M8; 294 x 293	4.00
BC4 to M8 + S$_8$ of G. *hirsutum* Cyt. B-line for G. *arborium* Cyt. male ster.; 293 selfed	4.00
BC$_1$ to M8 [(G. *anomalum* x G. *thurberi*) 4X M8] x M8; 460-9 O.P.	3.30
G. *anomalum* Cyt. BC$_2$ to M8; 460-9 x M8	3.80
BC$_6$ to M8 + S$_8$, B-line for G. *anomalum* Cyt. male sterile; 233 selfed	4.00
BC$_5$ to M8 + S$_8$, G. *anomalum* Cyt. male sterile; 234 selfed	4.00
G. *herbaceum* x male sterile 7A. 300 B selfed Gh. 1532 x St. 7A. Gh. 1532 from 6X G. *herbaceum* x M8 G. *anomalum*); 300 B selfed	4.00
M8 x 300 B-2	4.00
300 B-2 x M8	4.00
6X (G. *hirsutum* Cyt. x G. *herbaceum*)	4.00
[(AD$_3$ x M8) BC$_5$ to M8] x B-line for G. *anomalum* male sterile (=233); 219-L O.P.	4.00
G. *hirsutum* M8 Cyt. BC$_1$ from G. *tomentosum* second O.P. gen.; [M8 x (AD$_3$ D M8)] "S"$_2$	4.00
G. *tomentosum* Cyt. [(AD$_3$ x M8) BC$_5$ to M8] x B-line for G. *arborium* male sterile (=293); 218-22 O.P.	4.00
G. *harknessii* Cyt. BC$_2$ to Upland, selfed [(D$_{2-2}$ x M8) x Rowden] x M8, selfed	3.70
G. *hirsutum* Cyt. BC$_3$ of G. *harknessii* to Upland, M8 x 60F- 20	4.00
G. *harknessii* Cyt. BC$_3$ to Upland, 60F-29 x M8	4.00
G. *harknessii* Cyt. BC$_3$ to Upland, Gh. 1535-1, 2, 7 x M8	5.00
G. *harknessii* Cyt. BC$_2$ to Upland, Gh. 1535-2, 1, 7 x M8	4.00
F$_1$ (D$_2$ x D$_1$) *armouranium* x *thurberi*, SA 133	4.00
6X *hirsutum* x *herbaceum*, Z 147	4.00
6X *hirsutum* x *herbaceum*, Z 167	3.00
6X *hirsutum* x *anomalum*, Z 72	2.00
6X *hirsutum* x *raimondii*, Z 2379	2.00
6X *hirsutum* x *stocksii*, Z 69	4.00
6X *hirsutum* x *stocksii*, Z 144	4.00

ntries 1 to 21 obtained from Mrs. V. Meyer, Delta Branch Experiment tation, Stoneville, Mississippi.

t 45 days, the damage index was 2.00.

Table 5. Resistance of selected crosses of cotton to damage by the two spider mite.

Entry name	Damage score * 25 days
DPSL x Tex 223 BC$_2$S$_2$, sel. 5, selfed	3(14
DPSL x Tex 223 BC$_2$S$_2$, sel. 6, selfed	4(14
DPSL x Tex 223 BC$_2$S$_2$, sel. 7, selfed	4(14
DPSL x Tex 223 BC$_2$S$_2$, sel. 8, selfed	4(16
DPSL x Tex 223 BC$_2$S$_2$, sel. 9, selfed	4(1
DPSL x Tex 223 BC$_2$S$_2$, sel. 10, selfed	4(1
(Russian Sea Island x DPSL) F8	4(14
(Russian Sea Island x DPSL) F7	4(12)
[(Tidewater 372-4 x DPSL)F$_3$ x DPSL] S4	4(10)
[[)S.I. Seaberry x DPSL) x DPSL] selfed x same] x [gl. frego nectariless] selfed	4(26
do. selfed one additional generation	[illegible]
[[(S.I. Seaberry x DPSL) x DPSL] selfed x same] x same] x DPSL, selfed	4(18)
do, selfed one additional generation	4(19)
[(S.I. Seaberry x DPSL)], selfed	4(29)
do, selfed one additional generation	4(13)
DPSL x Texas 25 BC$_2$, S$_2$, sel. 6, selfed	4(15)
DPSL x Texas 25 BC$_2$, S$_2$, sel. 7, selfed	4(17)
DPSL x Texas 25 BC$_2$, S$_2$, sel. 8, selfed	4(9)
DPSL x Texas 25 BC$_2$, S$_2$, sel. 9, selfed	4(8)
Texas 25 x DPL-16, F$_1$	4(8)
Texas 59 x DPL-16, F$_1$	4(6)
Texas 66 x DPL-16, F$_1$	4(12)
Texas 69 x DPL-16, F$_1$	3(15)**
Texas 75 x DPL-16, F$_1$	4(10)
Texas 78 x DPL-16,F$_1$	3(12)**
Texas 80 x DPL-16, F$_1$	4(6)
Texas 84 x DPL-16, F$_1$	3(10)
Texas 87 x DPL-16, F$_1$	4 (8)
Texas 88 x DPL-16, F$_1$	4(13)
Texas 91 x DPL-16, F$_1$	4(12(
Texas 100 x DPL-16, F$_1$	4(10)
Texas 106 x DPL-16, F$_1$	4(8)
Texas 113 x DPL-16, F$_1$	4(18)
Texas 158 x DPL-16, F$_1$	4(12)
Texas 74 x DPL-16, F$_1$	4(32)
Texas 14 x DPL-16, F$_1$	3(19)
Texas 195 x DPL-16, F$_1$	4(14)
Texas 201 x DPL-16, F$_1$	4(11)
Texas 209 x DPL-16, F$_1$	4(18)
Texas 223 x DPL-16, F$_1$	4(9)
Texas 495 x DPL-16,F$_1$	4(4)

*First number is score; second number is number of plants observed.

**Score on parental race line was 4.0.

le 6. Resistance of selected interspecific crosses between Sea Island x Upland and other Louisiana breeding lines*

n number	*Damage index* *45 days***
intercross 1	4.04
intercross 2	4.16
intercross 3	4.02
5861	4.02
5881	4.04
5887	4.00
5892	4.02
5905	4.01
5906	4.00
5910	4.00
5913	4.00
5915	3.93
5994	4.28
65-38	4.00
65-42	4.03
S 12513	4.00
S 12522	4.00
S 12526	4.00
S 12527	4.00
-P 12548	4.00
-P 12555	4.00
-PA 92	4.04
-PA 124	4.00
-PA 128	4.20
-PA 147	4.06
-PA 315	4.03
-PA 331	4.10
-PA 358	4.08
-PA 366	4.00
-PA 409	4.01
-PA 414	4.04
-PA 452	4.29
-PA 484	4.21
ou SM1-6926	4.17
ou SM2-6931	4.13
ou SM6-6943	4.34

aterial furnished by Jack Jones, Louisiana State University.
ll lines scored 4.00 or greater at 25 days.

Table 7. Spider mite resistance in multiple disease resistant breeding lines.*

Family and Strain Designation	*Damage index* 25 days	*Damage index* 45 days
TAMCOT SP21 Family		
21-15-70, XT^2	4.00	4.00
21-16-71, X^2VFT^2	4.61	4.61
21-17-71, F	4.64	4.91
21-18-71, X^2T^2	4.50	4.60
21-19-71, X^2T^2	4.60	4.70
21-20-70, X^2T^2	4.32	4.54
TAMCOT SP23 Family		
23-7-70, XFT^3	4.38	4.75
23-8-70, XVT^3	4.07	4.21
23-11-71, $X^2F^2T^2$	4.09	4.27
23-12-71, X^3FT^3	4.09	4.09
TAMCOT SP37 Family		
37-3-70, XVT	4.00	4.00
37-8-70, XFT^2	4.00	4.00
37-9-70, XVT^2	4.00	4.07
37-14-70, XVT^2	4.00	4.00
37-16-70, X^2VT^3	4.07	4.07
37-17-70, X^2VT^3	4.07	4.07
37-19-70, XT^2	4.00	4.00
37-22-71, XVT^2	4.02	4.00
37-23-71, X^2VT^3	4.05	4.00
37-25-71, X^2VFT^3	4.06	4.00
37-26-71, X^2VT^3	4.00	4.00
37-27-71, X^2FT^3	4.00	4.00
37-28-71, X^2FT^3	4.02	4.00
37-29-71, X^2VFT^3	4.00	4.14
37-30-71, X^3	4.07	4.25
37-31-71, X^3VT^4	4.10	4.10
37-32-71, X^2VT^3	4.00	4.00
37-33-71, X^2VFT^3	4.00	4.00
37-34-71, X^2VFT^3	4.00	4.08
CAMD Family		
H^2-2-70,-	4.00	4.00
H^2-3-70,-	4.38	4.57
H^2-11-70,XT	4.18	4.64
H^2-12-70, XT	4.08	4.08
H^2-13-71, XFT	4.11	4.55
H^2-14-71,XFT	4.00	4.21
H^2-15-71, X^2T^2	4.43	4.77
H^2-16-71, XT	4.17	4.92
H^2-18-71, XT	4.60	4.10
H^2-19-71, XT	4.00	4.00
H^2-20-71, XT	4.00	4.00
H^3-6-71, XVT	4.00	4.14
H^3-7-71, XVT	4.00	4.00
H^3-8-71, XFT	4.21	4.43
H^4-3-71, -	4.29	4.36
H^4-4-71, -	4.20	4.50
H^4-6-71, -	4.17	4.41
H^4-7-71,-	4.42	4.64
H^4-8-71, -	4.15	4.25
H^4-9-71, -	4.00	4.00

7. Spider mite resistance in multiple disease resistant breeding lines.*

ly and n Designation	*Damage index* 25 days	45 days
-71, F	4.18	4.27
-71, XFT	4.18	4.67
-71,XT	4.18	4.36
-71, XT	4.00	4.00
-71, XT	4.00	4.00
-71, XFT	4.00	4.38
am Family		
70, -	4.37	4.73
70, -	4.50	4.73
71, V	4.33	4.56
71, V	4.56	4.56
1-71, XVT	4.07	4.69
3-71, XT	4.07	4.14
4-71, XT	4.10	4.40
5-71, XT	4.08	4.46
Family		
70, XT	4.00	4.23
70, XFT	4.00	4.00
71, V^2	4.00	4.00
71, V^2	4.15	4.28
71, XVT	4.23	4.46
71, XF^{2}T	4.07	4.07
-71, X^{2}VT^2	4.00	4.00
-71, XV^{2}T	4.00	4.00
-71, XV^{2}T	4.00	4.00
-71, XV^{2}T	4.00	4.15
n Family		
70, X^{2}T^2	4.00	4.25
70, XT	4.17	4.17
70, X^{3}T^3	4.08	4.08
70, X^{3}T^3	4.11	4.11
70, X^{3}T^3	4.38	4.38
-71, X^{3}T^3	4.00	4.00
-71, X^{4}T^4	4.00	4.10
-71, X^{4}T^4	4.00	4.10
nd Glandless Family		
71, F	4.00	4.08
-71, -	4.00	4.00
-71, -	4.00	4.00
-71, -	4.27	4.45
-71, -	4.36	4.36
-71, -	4.00	4.09
-71, -	4.08	4.08
-71, XT	4.17	4.42
0-71, XT	4.14	4.14
1-71, XT	4.08	4.08
2-71, XT	4.00	4.00
-71, -	4.00	4.07
-1-71, XT	4.00	4.07
ellaneous		
-71, -	4.08	4.18

terial furnished by Luther J. Bird, Plant Science Department, Texas A&M University, ge Station, Texas.

A Vacuum Cleaner Seed Dryer

By **R. K. Matthes** **J. C. Delouche**
M. S. Freire **J. D. Albritton**

MAFES

MISSISSIPPI AGRICULTURAL & FORESTRY EXPERIMENT STATION
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Bulletin 803

A Vacuum Cleaner Seed Dryer

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A Vacuum Cleaner Seed Dryer

Introduction

High seed moisture is the greatest single cause of losses in viability and vigor; therefore, it is of paramount mportance that seed moisture content after harvest be rapidly and safely reduced to 12% or less for the cereals and 11% or less for oil seed.

The fundamental factors necessary for drying seed are heat to evaporate the moisture and air to remove the moisture from the vicinity of the seed. How the air is heated or by what mechanism it is forced through the seed is immaterial to the drying process. It has been shown that the maximum allowable temperature for drying seed without decreasing the viability is from 85° to 110° F depending upon the type of seed, the moisture content of the seed and the relative humidity of the drying air.

There are many occasions when a small batch dryer is needed for drying seeds on an experiment station or for a plant breeder who deals with small seed lots from 3 to 10 bushels. For small seed lots of this size, it is possible to use an enclosed industrial-type vacuum cleaner to dry the seed.

Nearly all seed processing facilities have an industrial-type vacuum cleaner available for cleaning the floor in seed work rooms and cleaning the processing machinery either by normal vacuuming or high velocity air when the air hose is attached to the exhaust port. If the vacuum cleaner is constructed in such a manner that the incoming air passes the motor to provide cooling, the heat absorbed by the air is sufficient for drying seed.

The blower in most vacuum cleaners has the capability of developing a static pressure of 6 inches water column. Thus, an industrial-type vacuum cleaner has the capability of providing the two necessary components for drying seed: heat and air flow.

Characteristics of An Industrial-Type Vacuum Cleaner

The industrial-type vacuum cleaner used in this study was a Gustafson Booster Power Model. (Note: Trade names are used strictly for the purpose of giving a better description of the equipment used and in no way are meant as recommendations). This model has twin electric motors (575 watts each) with attached blowers: an upper motor and a lower motor. The two motors permit a high and low speed.

Essentially, the electrial input of the motor is converted to heat that raises the temperature of the air, except for a small amount of kinetic energy associated with the moving air and the heat loss in the hose from vacuum cleaner to the plenum chamber. Since the air moving through the seed is normally less than 30 cm/sec the kinetic energy is small, and since a short rubber hose is used from the vacuum cleaner to the plenum this heat loss is small. Since both of these quantities amount to a reduction of energy heating the air, the maximum temperature rise with one or two motors can be determined.

The heat input (BTU/Hr) can be approximated by multiplying the air flow (CFM) by the temperature rise (° F) of the incoming air. Since 3.413 BTU/Hr is equal to 1 watt, the 575 watts of one motor is equal to 1963 BTU/Hr. Therefore, the temperature rise (° F) is approximately 1963 BTU/Hr divided by the air flow (CFM).

For the recommended minimum air flow of 10 CFM bushel using one motor of the vacuum cleaner there is sufficient heat energy to raise the temperature of the ambient air 60° F for drying 3 bushels of seed or 30° F for drying 6 bushels of seed. When using two motors there is sufficient heat energy for raising the temperature of the ambient air 30° F for drying 12 bushels of seed.

Experiment Vacuum Cleaner Dryer

Feasibility tests were conducted with an experimental seed dryer which consisted of the Gustafson Booster Power Model Vacuum Cleaner and a 12 x 12 x 48 inch high seed bin fitted with perforated metal flooring. Three of the bin walls were constructed of ¼ in. plywood and the remaining wall was made of ¼ in. plexiglass to permit visual observation of the seed during the drying operation. The bin was attached to a plenum chamber which was 24 x 24 x 5 inches deep. A 2-inch aluminum pipe 8 inches long was fitted into an opening in the middle of the bottom of the plenum chamber to provide a means of connecting the vacuum cleaner hose.

Two tests were run using the experiment vacuum cleaner dryer to dry rice seed. One hundred forty pounds of rice seed at 17.7% (wet basis) moisture were placed in the seed bin filling it to a depth of 42 inches. One motor was used on the vacuum cleaner.

Seed moisture content was reduced in 12 hours from 17.7% to a range of 8.8% to 12.3% at the 6 to 38 inch seed depth respectively (Figure 1). Thereafte drying progressed slowly and at the en of the 48-hour drying test the fin moisture contents were 7.0 and 8.0% the 6 and 36 inch depths, respectively

Temperatures developed in the dryin system during the drying period ar shown in Figure 2. The temperature wa always highest in the plenum where th air entered the seed mass, and decrease from the bottom to the top of the bin Over-all temperatures in the system in creased as seed moisture conten decreased and as ambient temperatur increased. Maximum temperature ris over the ambient condition was 25-30° F and was achieved without supplementa heat. The temperature rise was very uniform.

The second drying test using the experimental dryer was conducted with rice seed having 20.7% initial moisture content. The atmospheric conditions during this period were characterized by high relative humidity averaging above 80%. Results of this test (Figure 3) were similar to those of the first test. The more frequent sampling interval (2 hrs. for the first 8 hours) revealed that the most rapid rate of drying occurred during the first 6 hours, and also that the maximum difference in moisture content of the seed from bottom to top of the bin (approximately 8%) was attained at 8 hours. This indicated that drying has occurred in the lower portion of the seed bed but no drying has occurred in the top layer of seed. This test demonstrated that the vacuum cleaner dryer was effective in drying rice seed even under relatively adverse drying conditions (70° F, 80% RH).

Operational Small Batch Seed Dryer

Based on the feasibility studies using the experimental dryer and availability of materials an operational small batch ed dryer to be used with the industrial pe vacuum cleaner was constructed nd tested.

Construction of Dryer

A 55-gallon drum with an open top igure 4 and 5) is used for the seed ontainer. A perforated false floor is onstructed 6 inches above the bottom f the barrel to form a plenum chamber nderneath. A hole is cut in the side of he barrel below the false floor, and a hort length of pipe is welded to the utside. This pipe is used for attaching he vacuum cleaner hose to the seed ontainer.

The drum is suspended in an A-frame o allow the seed to be removed easily fter drying. The frame is constructed of ½ inch angle iron. A ¾ inch steel rod is placed horizontally through the center of the drum 1/3 the distance from the op. This rod is welded to the sides of the drum and extends approximately 8 nches on either side providing points of support on the A-frame. When the barrel is filled with seed the location of the rod causes the seed above the rod to act as a counter balance which aids in pivoting the barrel for removing the seed.

Evaluation of the Seed Dryer

Drying tests were run to evaluate the operational vacuum cleaner seed dryer. The temperatures during the drying tests were measured by a Digital Thermometer Model 501N - United Systems Corporation. The temperature was determined for the ambient air, the incoming drying air and the exhaust air from the seed bed.

The static pressure was measured with a Dwyer-Manometer 1215-24, F.W. Dwyer, M.F.G., Co.

The relative humidity during the drying time was measured at one-hour intervals by a Bacharach-Pittsburg sling psychometer.

During the drying period, samples of 30-50 grams were taken at three different levels at one hour intervals using a trier which was inserted into the mass of seeds from the top to bottom. The air oven method was used to determine the moisture content of the samples. The temperature in the oven was set at 105°C and the sample was dried for 24 hours. The moisture content determinations were on the wet basis.

The first six tests were run to study the temperature rise and the static pressure developed in the dryer. It was established that only one motor would be necessary to dry one barrel of seed (approximately 4½ bushels).

One test was run using both motors of the vacuum cleaner to dry one barrel of seed. During this test the drying air temperatures exceeded 130°F which was approximately a 50°F temperature rise from ambient conditions. Another test was run using both motors on two barrels of seed and the drying air temperature exceeded 117°F. Therefore, since 110°F is the maximum temperature at which the seed can be dried safely, both motors should not be used unless more than two barrels of seed are being dried or ambient temperatures are less than 60°F.

The remaining tests were run using one barrel of seed at a depth of approximately 20 inches and one motor on the vacuum cleaner. Typical temperatures developed during the drying tests are shown in Figure 6. The temperature rise was very uniform and ranged from 20 to 30°F. The static pressure ranged from 0.10 to 0.35 inches of water column. From Figure 6 it is noted that the temperature estimated by dividing the 1963 BTU/Hr of heat energy produced by one motor of the vacuum cleaner by the 22°F temperature rise. This equals to approximately 90 CFM.

One barrel holds approximately 4½ bushels of seeds; therefore, the specific air flow is 20 CFM/bu which is well above the minimum 10 CFM/Bu recommended for drying (2,12).

The last four drying tests were run to determine if the vacuum cleaner dryer could be used to dry several different types of seed in a reasonable period of time. Ear corn, soybeans, wheat and rice were dried and the graphs (Figures 7, 8, 9 and 10) indicate that the decrease in moisture content of all the seeds is sufficient to warrant the conclusion that the dryer can be used to satisfactorily dry up to 4½ bushels of seed. Similar tests indicate that 9 bushels of seed can be dried using two seed containers (55 gallon drums) and the high speed (2 motors) or low speed (1 motor) on the industrial-type vacuum cleaner depending upon the ambient temperature.

General Discussion

Evaluation of the vacuum cleaner seed dryer indicated that it is a very efficient heat and air source for drying small batches of seed. Vacuum cleaners of the type used are readily available for seed and plant laboratories and they are quite durable.

In the evaluation tests, the vacuum cleaner was operated with one motor. Nevertheless, it dried the seed very efficiently and built up a very high static pressure of about 6.5 inches in the experimental dryer having a one-square foot cross-sectional area and a 36 inch depth of rice. In the operational seed dryer 4½ bushels (one barrel) of various types of seed were dried satisfactorily using one motor of the vacuum cleaner and nine bushels (two barrels) of seed were also dried satisfactorily using one motor of the vacuum cleaner. It appears that 12-15 bushels of seed could be dried using both motors of the vacuum cleaner. Temperature measurements taken during drying showed that temperature rise in the system was on the order of 25-30° F over the ambient temperature. Since 110° F is the maximum temperature for seed drying, use of the vacuum cleaner at ambient temperatures above 70-75° F could be detrimental to viability of seed. If the drying air temperature exceeds 110° F, can be reduced by increasing the air flow through the vacuum cleaner. A reduction of the resistance to the air flow through the seed will result in an increased air flow, and this can be accomplished by reducing the depth the seed or by increasing the cros sectional area through which the a moves. This can be done by addir another barrel to the exhaust hose of th vacuum cleaner.

Obviously if one is interested in usin a vacuum cleaner it will be necessary t run sufficient evaluation tests to deter mine the volume of seed and the dept of seed which can be dried using you particular vacuum cleaner. The best indication of how effective a drying system is can be determined by measuring the reduction of moisture content in the top layer of seed in the dryer. This layer should be reduced to a satisfactory storage moisture content in at least a 48 hour drying period.

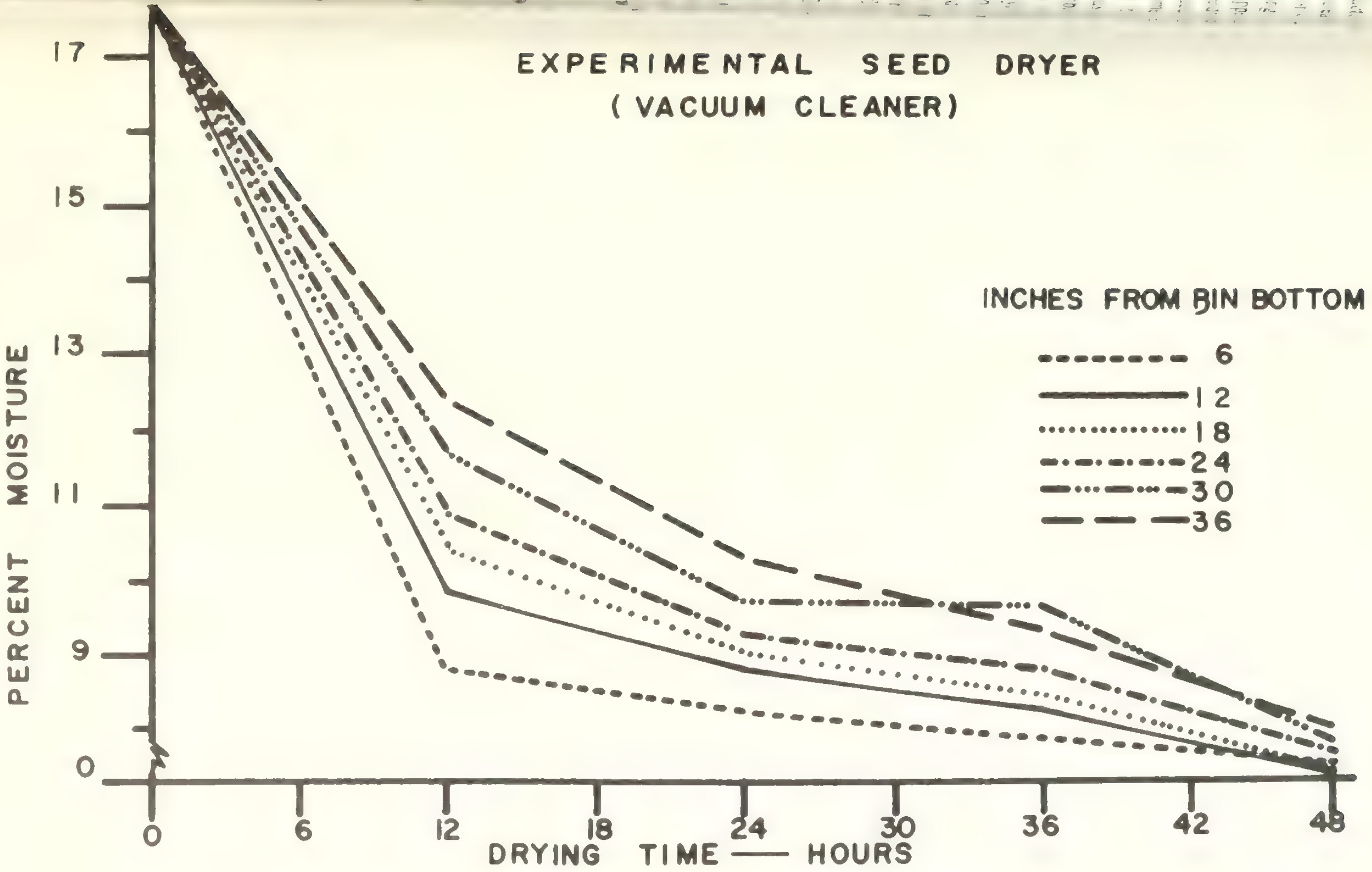


Figure 1. Drying rate of rice in the first test using the experimental dryer.

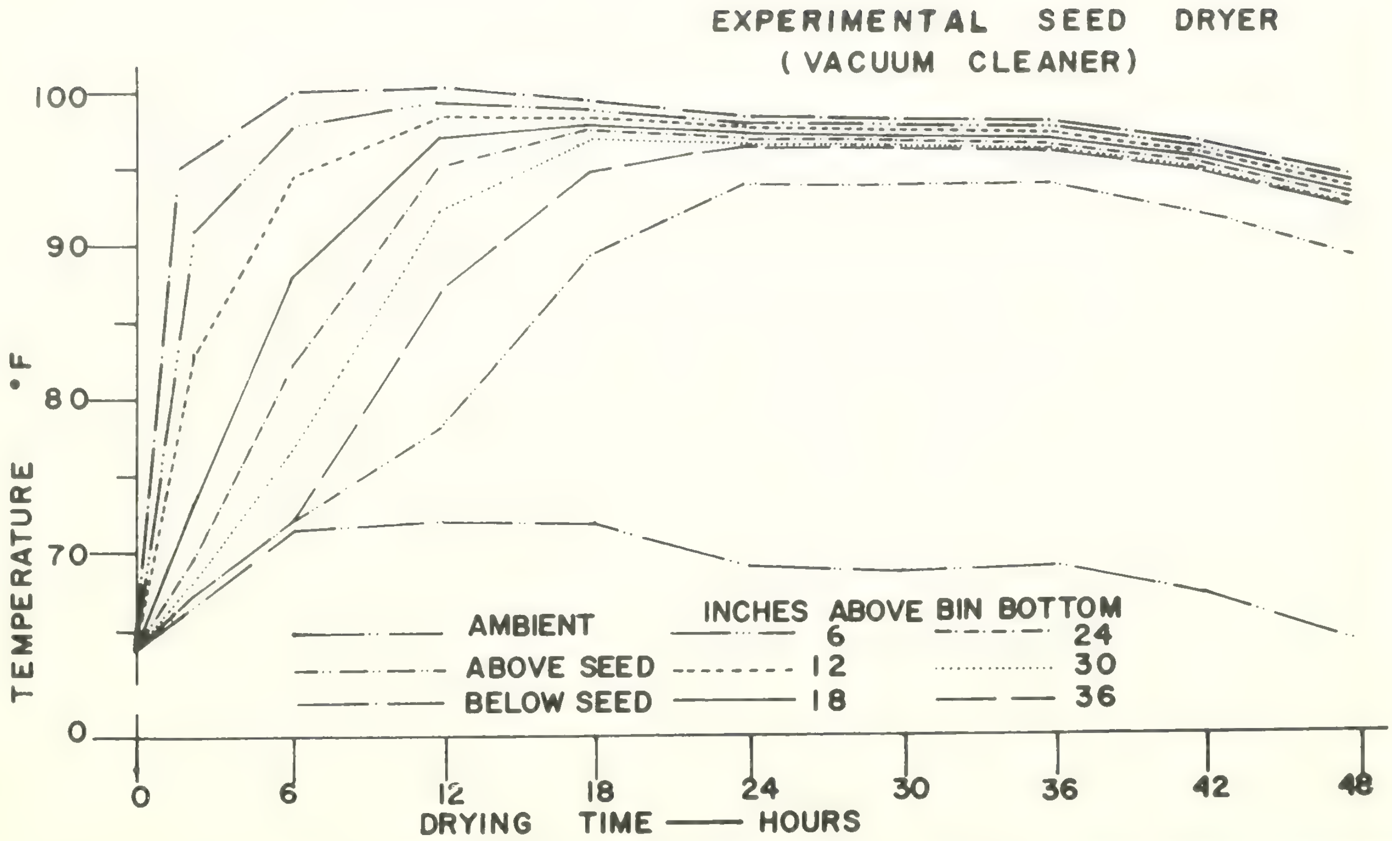


Figure 2. Temperature of rice versus time in the

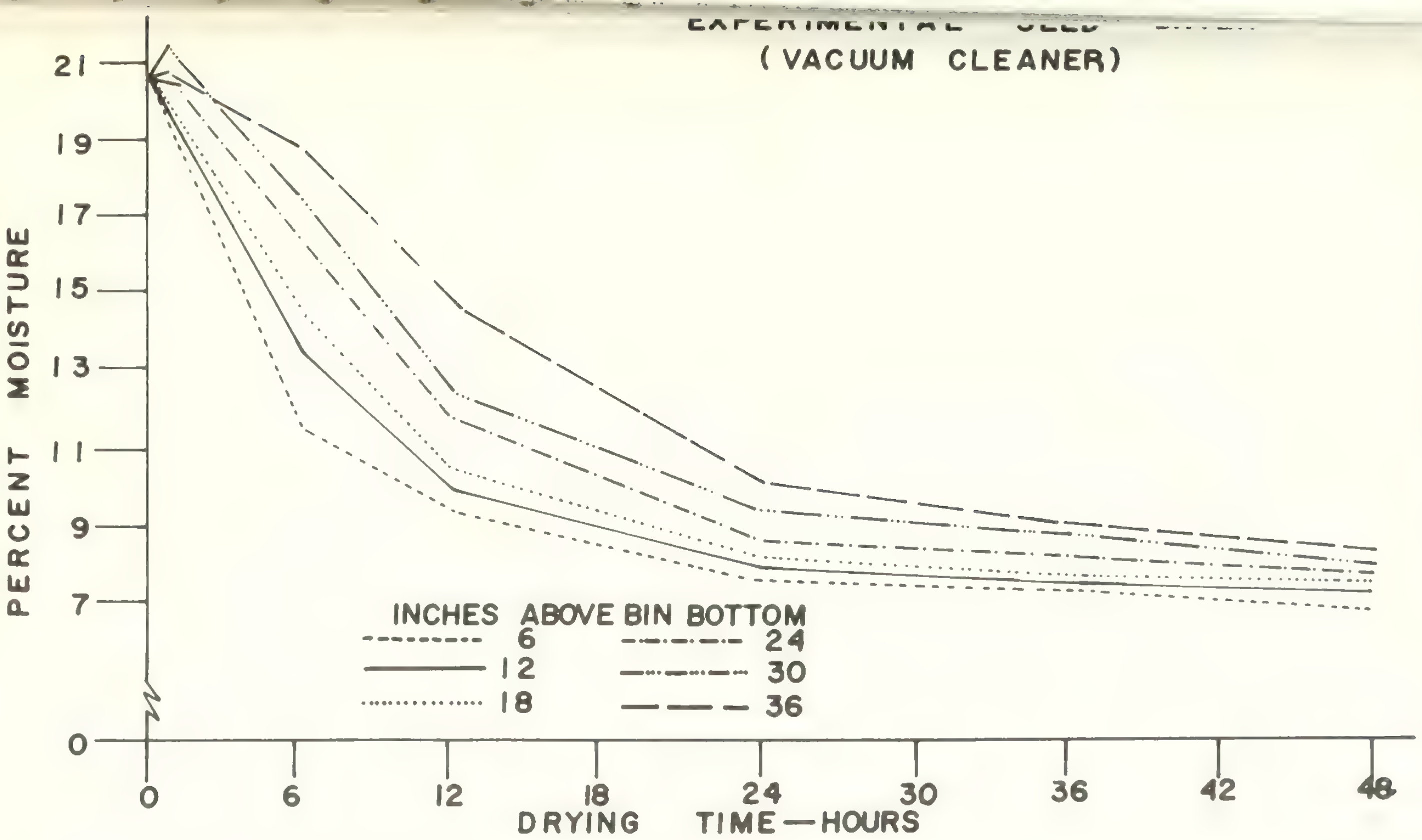


Figure 3. Drying rate of rice in the second test using the experimental dryer.

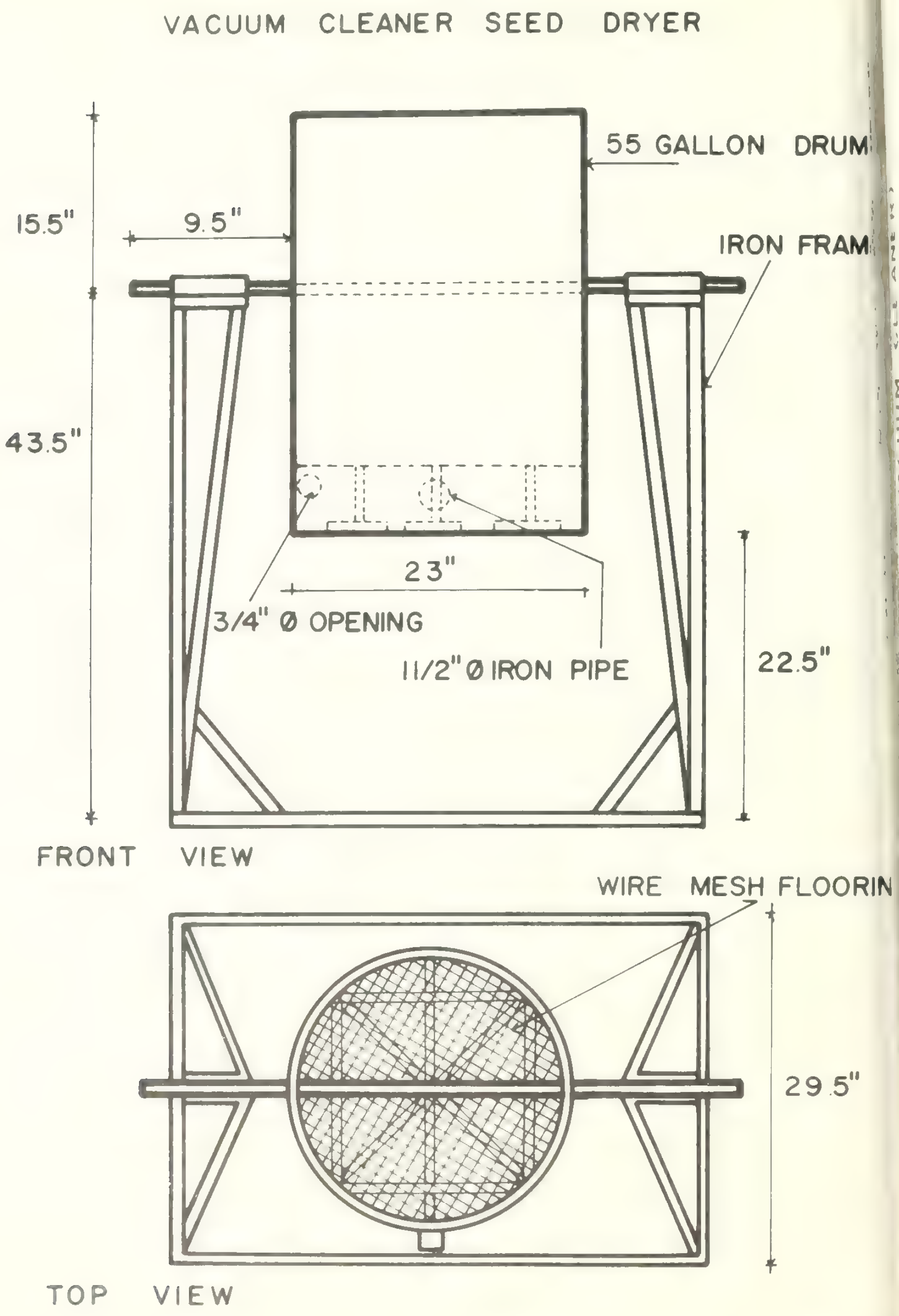

VACUUM CLEANER SEED DRYER
55 GALLON DRUM
15.5"
9.5"
IRON FRAM
43.5"
23"
3/4" Ø OPENING
11/2" Ø IRON PIPE
22.5"
FRONT VIEW
WIRE MESH FLOORIN
29.5"
TOP VIEW

Figure 4. Construction detail of the seed container of the small batch seed dryer.

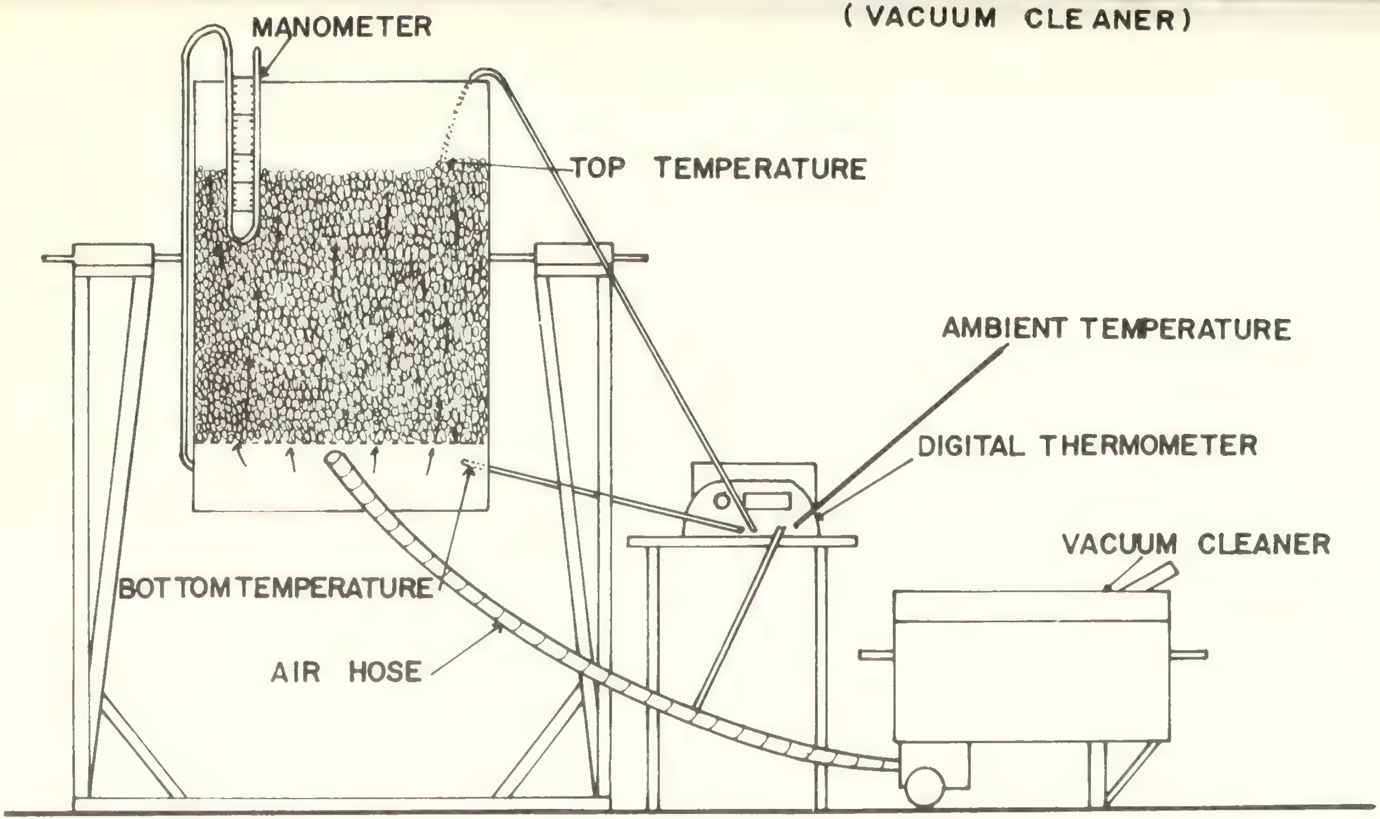

(VACUUM CLEANER)
MANOMETER
TOP TEMPERATURE
AMBIENT TEMPERATURE
DIGITAL THERMOMETER
VACUUM CLEANER
BOTTOM TEMPERATURE
AIR HOSE

Figure 5. General arrangement of the small batch seed dryer.

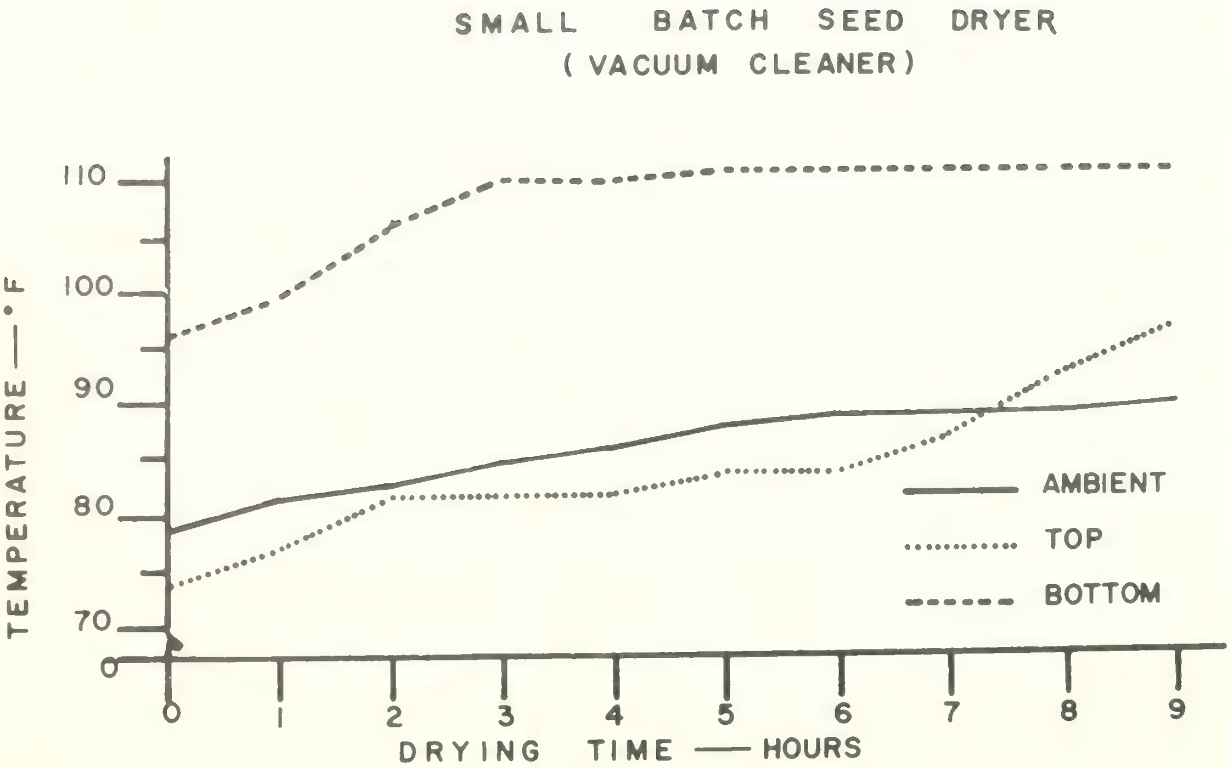


Figure 6. Temperature versus time for seed dried in the

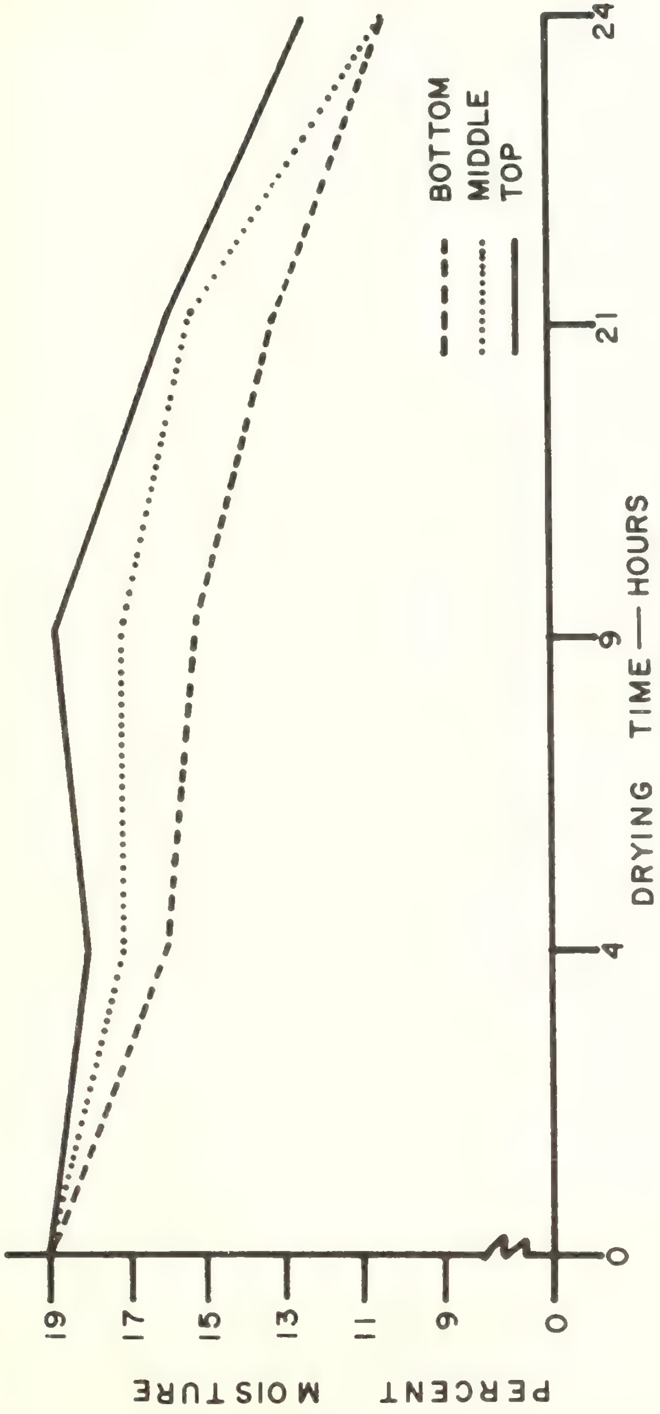
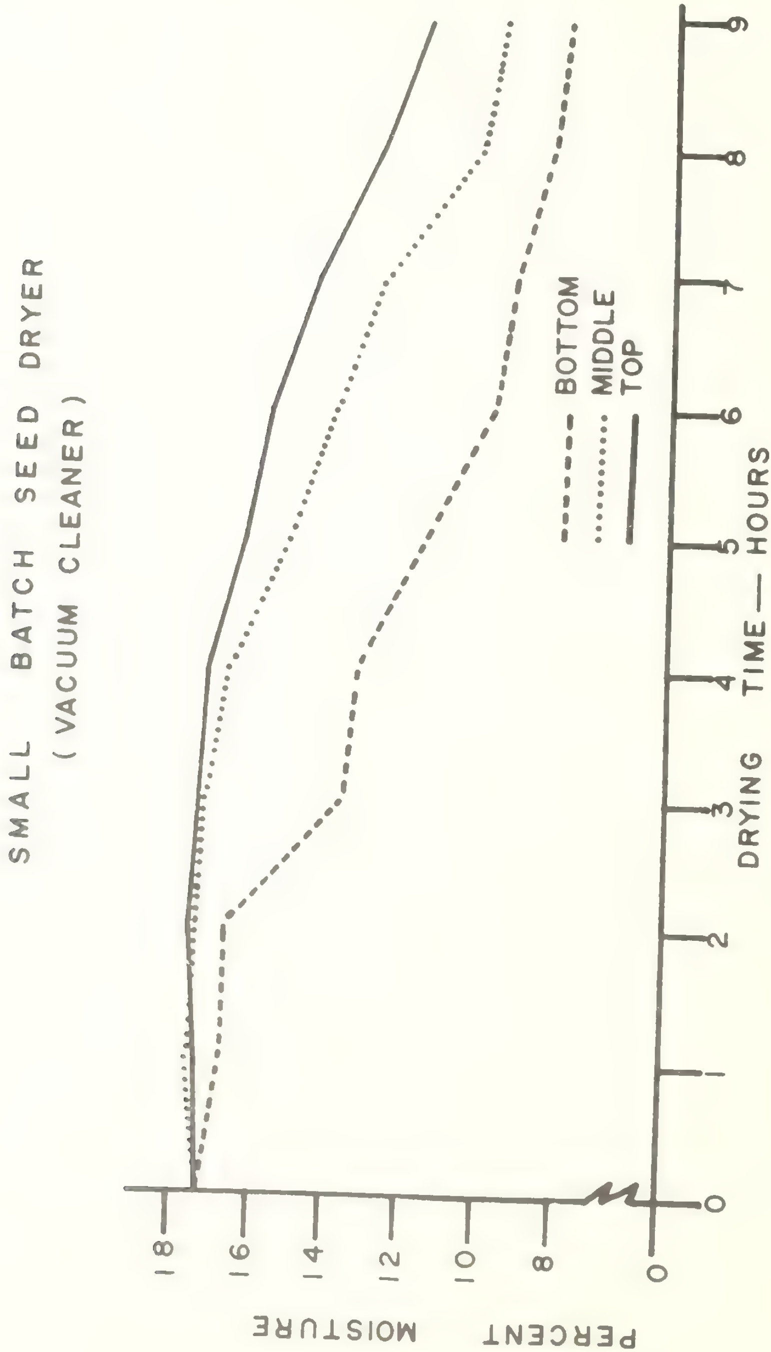


Figure 7. Drying rate of ear corn in the small batch dryer.



igure 6. Drying rate of soybeans in the

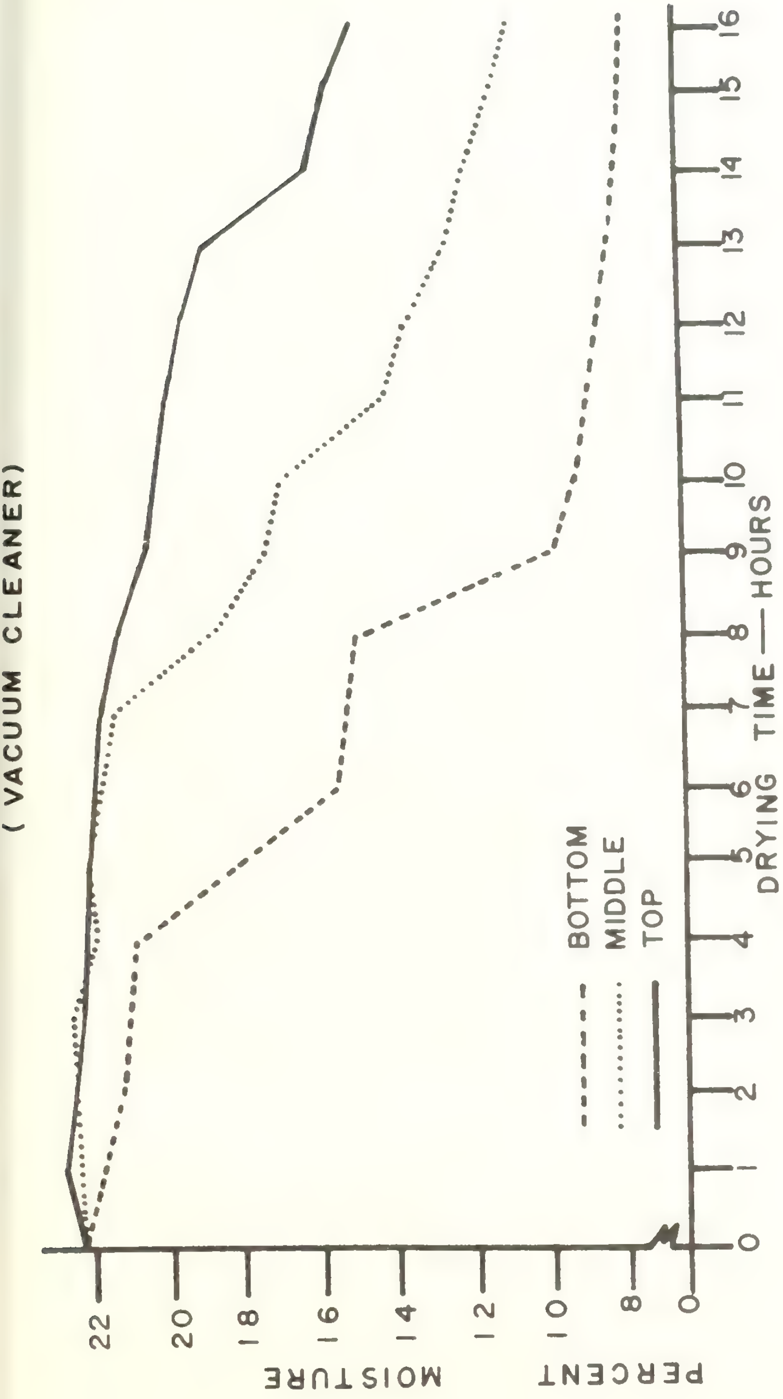
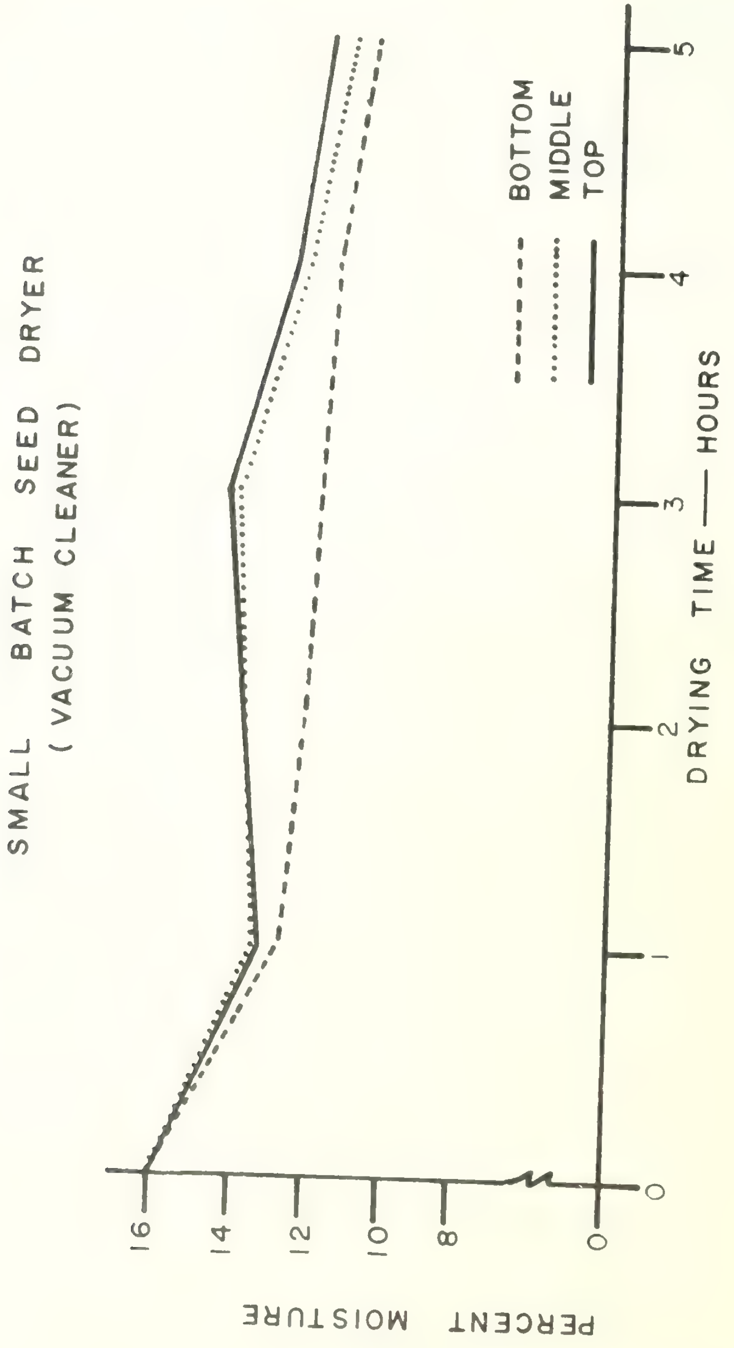


Figure 9. Drying rate of wheat in the small batch dryer.


SMALL BATCH SEED DRYER
(VACUUM CLEANER)
BOTTOM
MIDDLE
TOP
PERCENT MOISTURE
16
14
12
10
8
0
DRYING TIME — HOURS
0
1
2
3
4
5

973

Bulletin 804

Influence Of Planting Method And Plant Population On Cotton

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MISSISSIPPI AGRICULTURAL & FORESTRY EXPERIMENT STATION
James H. Anderson, Director
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Bulletin 804

Influence of Planting Method and Plant Population On Cotton
(Gossypium hirsutum L.)

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Influence of Planting Method and Plant Population On Cotton *(Gossypium hirsutum L.)*

Abstract

determine the effects of variations plants/hill, within-row plant ngs, and plant populations on the iomic and fiber properties of n (*Gossypium hirsutum* L.), we ated the performance of 'Deltapine hen planted in hills and drilled at opulations over a 3-year period -71). Hills were spaced 16 in. apart. ills were thinned by hand to 1, 3, 5, d 9 plants/ hill, representing a in population of 10,000 to 90,000 s/acre. Plants in the drill plantings spaced approximately 15.0, 5.0, 2.1, and 1.7 in. apart to provide apimately the same populations for hill-dropped and drill planting od.

gnificant differences in yield due to lations were found, but planting od had no significant influence on . The highest yields each year were ned in a population range of 28,000 ,000 plants/A. In 2 out of 3 years, ighest yields were obtained with a lation of 45,000 to 49,000 plants/A lants/hill or plants spaced 3 in. t). Significant differences in lint entage, boll size, and seed index due to populations. The combined indicates no appreciable diffces in lint percentage; however, lint entage of the low population was ficantly higher than that of the two est populations in 2 of the 3 years. Boll size gradually decreased as plant population increased, with the lowest population usually producing significantly larger bolls and seed.

We found that plant populations had no consistent effects on fiber length, fiber strength, and fiber elongation. The differences were small in magnitude and of no practical value. Micronaire tended to decrease as population increased.

In the past 25 years, substantial progress has been made in the development of cotton varieties adapted to mechanical production and machine harvesting. Estimates made by the Consumer Marketing Service of the U.S.D.A. (17) indicate that in 1970, 98% of the total cotton crop was mechanically harvested. Further improvements in production efficiency are needed for cotton producers to grow cotton in a profitable manner. Technological changes that will result in equal or greater yields of quality fiber at a lower production cost will improve cotton's highly competitive position with man-made fibers.

Large increases in crop yields have played a major role in the improvement and efficiency of farm production. Although several factors affect the ultimate value of cotton, yield remains the primary consideration in farmers' choice of varieties and in determining the profitability of cotton production. Cotton acreage controls and price supports encourage the cotton producer to make every effort to produce maximum yields.

Planting to an optimum stand is one method of reducing cost and helping to insure satisfactory yield, as cotton yields are directly influenced by the number of plants obtained at planting. Since the seed planted represents a part of farmers' cash inputs, the fundamental relationships of crop yield and plant population is an important consideration. The purpose of this study was to evaluate drill and hill planted cotton to determine the optimum plant population and planting method.

Materials and Methods

The performance of 'Deltapine 16' was evaluated when planted in hills and drilled at five plant populations. Hills were spaced 15 in. apart. After emergence, each hill was thinned by hand to 1, 3, 5, 7, and 9 plants per hill, representing a range in population of 10,000 to 90,000 plants/ A. Plants in the drill planting were spaced approximately 15.0, 5.0, 3.0, 2.1, and 1.7 in. apart in order to have approximately the same populations for the hill-dropped and drill planting methods. In some instances slightly higher plant populations were obtained for the drill plantings because of the difficulty of getting a large number of plants in a hill to live. Missing or incomplete hills and skips in the drill plantings were replanted.

This study was conducted on a Bosket very fine sandy loam soil at Stoneville, Miss., for a 3-year period (1969-71). A split-plot design with seven replications was used each year. Main plots were plant populations and subplots were planting methods (drill and hill-dropped). Each plot consisted of two rows 59 ft. long with 40 in. spacing between rows. All seed received an in-furrow treatment of a fungicide and systemic insecticide. The study was planted on April 23 in 1969 and 1970 and on April 19 in 1971.

Immediately prior to first har sample consisting of 100 bolls was picked from each treatment in ea plication. These samples were u determine boll and seed size, lint pe tage, fiber length (2.5% and 50% length), fiber strength (g/tex), elongation, and fiber fineness (Mi aire). Tests were harvested with a dle picker.

Results and Discussion

Lint Yield

We found significant differenc yield due to populations, but pla method had no significant influen total yield in the combined analysis years. Significant year x populatio year x planting method interac were measured. In 1969 and (Tables 1 and 3) the low plant p lation (approximately 11,000 plant yielded significantly less than hi populations (28,300 to 81 plants/A). The highest yields each were obtained in a population rang 28,300 to 49,000 plants/A. Our res (Table 4) show that yield increase the population was increased to 47 plants/A. As populations incre above that level, yield decreased, bu yield decline was more gradual tha the low populations. Our data ar agreement with the theory of p population and crop yield as revie by Holliday (9). The theory holds th crops where yield is some product of crop's growth in the reproductive ph the relationship curve between yield population is approximately parab in shape (Figure 1). In 2 of the 3 ye the highest yields were obtained wit population range of 45,000 to 49, plants/A (5 plants/hill or plants spa 3.0 in. apart). Similar results were tained by Hawkins and Peacock (7) w found the highest average yield was tained from 5 plants/hill spaced 16 apart (48,750 plants/A). Dick and Lu so found that 3 to 6 plants/hill gave est yield results in both 18 in. hill-ped and 40-in. cross-plowed n. Tugwell and Waddle (16) ob-d no significant differences in yield 3 years of testing where they com-d one plant/hill with three to five ts/hill in hills spaced 14 in. apart.

eports by other researchers on the num spacing and population have found to be quite variable. Ray et 14) obtained no differences in yield plant spacings of 2 to 10 in. (15,000 5,000 plants /A). Hawkins and ock (8) found that the highest yields obtained when populations were in a range of 38,866 to 58,300 ts/A. Hughes (10) reported that s-plowed stands (20,000 plants/A) ed to produce slightly less lint than dropped stands (55,000 plants/A) nthinned stands (70,000 plants/A). itton (1), Burch (2) and Leding and on (12) reported that one plant per (approximately 13,000 plants/A) luced the highest yield. Burch (2) d that plant spacings of 6 and 12 ts per foot (74,675 and 149,350 ts/A) significantly reduced lint d. Douglas, Brooks, and Farschtchi found that 30,000 plants/A pro-ed the highest yields.

n 1969, (Table 1) drill-planted cotton consistently higher in yield than dropped cotton. Similar results e obtained in 1971 (Table 3) except one population (45,466 plants/A) in ch hill-dropped cotton was slightly her in yield. Hill-dropped cotton duced slightly higher yields in 1970 opulations below 50,000 plants/A; ve this population the drill-planted on yielded slightly more (Table 2). re was a trend for drill-planted on to produce slightly higher yields, ecially with high populations (Figure n 2 out of 3 years significantly higher ds were obtained from drill plant-. This was probably due to the petitive effect between plants in a hill at high populations as compared with plants uniformly spaced in a row.

In 1969 and 1971 (Table 1 and 3) the low population (10,500 plants/A) was slightly later in maturity than the higher populations based on the yield at first harvest. No differences in maturity between populations were indicated in 1970 (Table 2). Similar conclusions were drawn by Tugwell and Waddle (16), Lane (11), and Peebles, Den Hartog, and Pressley (13). Dick and Lund (3) observed no difference in maturity from 3 years of testing with populations ranging from 8,700 to 122,000 plants/A when hills were spaced 18.0 in. apart. Burch (2) reported that thinner spacings promoted earliness.

Lint Percentage

We found significant differences in lint percentages due to populations, but planting methods had no significant influence on lint percentage. Significant year x population and year x planting method interactions were measured. In 1969, (Table 1) lint percentage of the low population (10,813 plants/A) was significantly lower than that of higher populations (28,334 to 80,535 plants/A). The reverse was true in the two following years. The two lower populations (10,527 and 30,627 plants/A) had significantly higher lint percentages than the higher populations (48,274 to 80,531 plants/A) in 1970 (Table 2). Lint percentage of the low population (10,536 plants/A) was significantly higher than the two largest populations (61,491 and 72,566 plants/A) in 1971 (Table 3). In 2 of the 3 years, lint percentage of the lowest population was significantly higher than that of the two highest populations. The 3-year average (Table 4) shows no appreciable advantage of one population over another for lint percentage. Hawkins and Peacock (8) reported that lint percentage was highest at populations of 19,433 plants/A or less, but an increase of 375 lb/A in the average yield for populations of 38,866 plants/A more than compensated for the advantage gained in lint percentage at lower populations. Several researchers (3, 4, 6, 13) found no differences in lint percentage.

Boll Size

Boll size is expressed as the weight in grams per boll. We found significant differences in boll size due to populations, but not for planting method. The year x population interaction was significant. There was a general decrease in boll size as plant population increased. These results agree with data reported by Burch (2), Dick and Lund (3), Feaster, Turcotte, and Briggs (6), Peebles et al. (13), Hawkins and Peacock (8) and Tisdale (15) who found regular decreases in boll size as the number of plants/A increased. Hughes (10), in studies involving two fertilizer rates and three spacings, reported that boll size was largest in cross-plowed cotton, smallest in hill-dropped cotton and intermediate in unthinned cotton. Lane (11) concluded that there was a slight increase in boll size as the space between cotton plants increased from 3.0 to 12.0 in. Duncan and Pate(5) reported that boll size was not influenced by several in-row spacings at populations below 26,136 plants/A.

Seed Index

Seed index is a measure of seed size expressed as the weight in grams of 100 seed. We found significant differences in seed index due to populations, but planting method had no significant influence on seed index. Seed index of the low plant population (approximately 10,500 plants/A) was significantly higher than the other populations (28,334 to 80,535 plants/A) in 1969 and 1971 (Table 1 and 3). There were no significant differences in seed index in 1970 (Table 2). The 3-year average (Table 4) shows a trend for seed index populations to be slightly hig Hawkins and Peacock (8) repo gradual, but insignificant decre seed size as spacing was change 24 to 8 in. Peebles et al. (13) re that seed size was not substa influenced by spacing. Burch (ported that lower numerical valu seed index were usually obtaine each increase in plant populatio

Fiber Length

Fiber length was not signif influenced by plant population planting method in the co analysis of 3 years, but the population interaction was signi In 1969 (Table 1) fiber of th population (10,813 plants/A) significantly longer than that of t highest populations (61,708 and plants/A). The low populations h shortest fiber in 1970 (Table 2) 1971 (Table 3) there were no sign differences in fiber length. These suggest that on the average, popu changes have very little influen fiber length (Table 4). Bur reported that significant diffe between plant spacings occurred of two years for fiber length. Dur year that significant diffe occurred, consistently lower num values were measured for fiber and length uniformity as the population increased. Tugwel Waddle (16) in comparing single hills and hills containing three plants per hill spaced 14 in. apart, that fiber length from single plan was significantly longer in one three years. This is in agreement w results we obtained. Other worker 10, 13) reported no effect on fiber from several plant populations.

Fiber Strength

We found significant differen fiber strength due to planting me but not for plant populations. Th anting method interaction was ficant. There was a slight trend for hill-dropped plantings to have nger fiber than the drill plantings. e differences were very small and f no practical importance. Similar ts have been reported by Dick and d (3), Douglas et al. (4), Hughes and Tugwell and Waddle (16), who d no difference in fiber strength due opulations.

awkins and Peacock (8) found that r strength was influenced by hill cings, but not by the number of nts per hill. Their analysis showed a dual but significant decline in fiber ngth as hills were spaced closer. bles et al. (13) reported a 3% uction in fiber strength of Upland ton, which they associated with close cings. Feaster et al. (6) found that se spacings produced weaker fibers in na cotton. Burch (2) reported that er strength was reduced significantly h high plant populations.

Fiber Elongation

We found no significant differences in er elongation due to population and nting method. No significant inter- ions were found. Burch (2) found at significant differences between nt spacing occurred in only one of o years for fiber elongation. In com- ring 1, 3, 6, and 12 plants/ft. , he und that fiber elongation increased to plants/ft. and then decreased at the 12 nts/ft. spacing.

Fiber Fineness

We found significant differences in icronaire reading due to populations. e year x population interaction was gnificant. The 1970 and 1971 results able 2 and 3) shows the Micronaire of e lowest population to be signifi- ntly higher than that of other popu- tions studied. No significant fference in Micronaire was observed 1969 (Table 1). In 1971, the low population (10,536 plants/A) had the highest Micronaire, populations of 30,152 to 46,178 plants/A were intermediate, and populations of 61,491 to 75,566 plants/A had the lowest micronaire value. The general trend (Table 4) was for Micronaire to decrease as plant population increased. Similar results were reported by Tugwell and Waddle (16). They measured significantly higher Micronaire of single plant hills compared to hills containing three to five plants in 2 out of 3 years. Feaster et al. (6) found finer fibers of Pima cotton associated with close spacing. Hughes (10) found that the lowest plant population (20,000 plants/A) and the highest fertilizer rate increased coarseness of fiber. Peebles et al. (13) found no effect of spacing on fiber fineness in Upland cotton except for one experiment in which fine fiber was associated with close spacing.

Summary and Conclusions

The highest yields each year were obtained in a population range of 45,000 to 49,000 plants/A. In 2 of 3 years, the highest yields were obtained with a population of 45,000 to 49,000 plants/A (5 plants/hill or plants spaced 3 in. apart). There was a trend for yield to increase with increased populations up to 47,812 plants/A and to gradually decrease at populations above this level. Drill planted cotton tended to produce slightly higher yields, especially with high populations. This was probably due to more competition between plants in a hill as compared with plants uniformly spaced in a row. In 2 out of 3 years maturity was delayed with the low population.

In 2 of the 3 years, lint percentage of the lowest population was significantly higher than that of the two highest populations. The 3-year average indicates no appreciable differences in lint percentage.

There was a general decrease in boll

size as plant population increased, with the lowest population usually producing significantly larger bolls and seed.

Plant populations had no consistent effects on fiber length, fiber strength, and fiber elongation. The differences were small in magnitude and of no practical value. There was a general trend for Micronaire to decrease as population increased. In 2 of the 3 years micronaire of the lowest population was significantly higher than the other populations tested. Fiber characters are relatively stable over a range of plant populations and cotton will produce satisfactory yields over a range of populations provided the stand is uniform.

The low and very high populations appear to have the greatest effect on production. There appears to be no advantage to growing cotton at very high populations.

Environmental conditions influence the growth habits of cotton at different populations. In dry years there is competition among plants for moisture, particularly with high populations, and in wet years the competition is probably more for sunlight. The competition that exists probably explains why drill planted cotton appears to be slightly associated with better yields, particularly with high populations.

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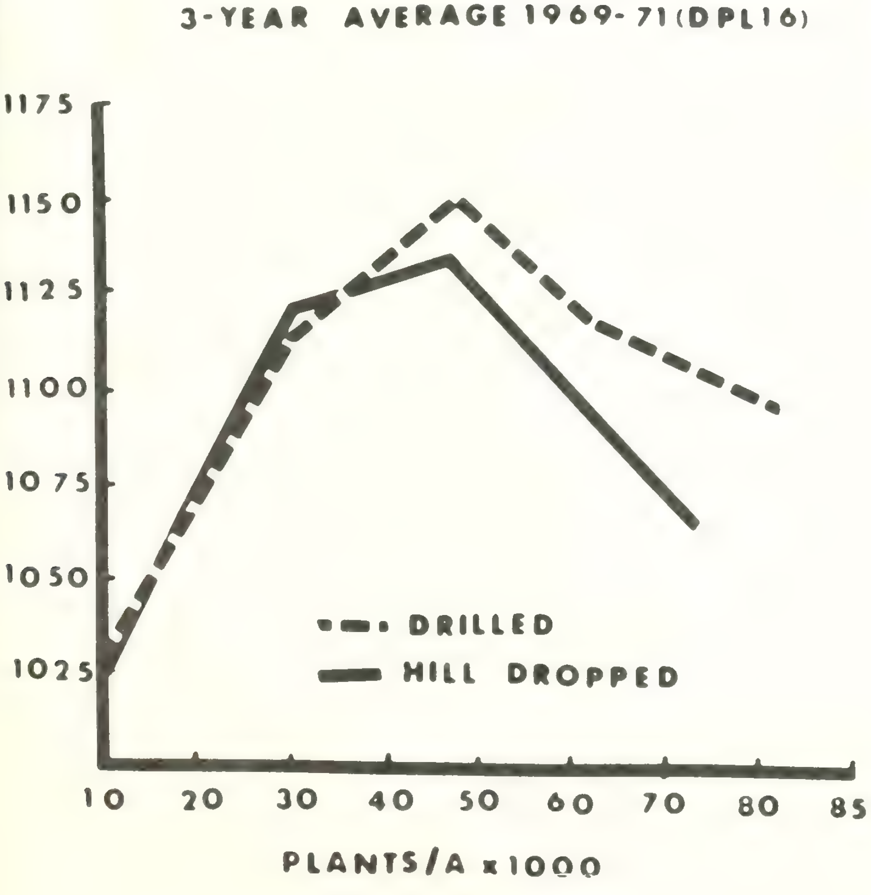


Table 1. The effect of drill and hill planting at five plant populations on the agronomic and fiber properties of Deltapine 16 at Stoneville, Miss. in 1969.

		Lint Per Acre						*Fiber Properties*				
								Length				
	Plants per acre	*Total*	*First pick*	*Percent first pick*	*Lint percent*	*Seed index*	*Boll size grams*	*2.5%*	*50%*	*Stgth. gms/tex*	*Elonga-tion*	*Micro-naire*
1 plant per hill	10,315	686	573	83	32.2	11.5	6.09	1.21	.59	21.88	9.43	4.40
1 plant per 15 inches	11,311	726	617	85	32.8	11.5	6.12	1.21	.59	21.43	9.41	4.45
Average	10,813	706 c	595 c	84	32.5 b	11.5 a	6.10 a	1.21 a	.59	21.65 a	9.42 a	4.42 a
3 plants per hill	30,217	815	684	84	33.5	11.1	5.89	1.19	.59	22.14	9.46	4.46
1 plant per 5 inches	26,452	825	717	87	33.2	11.2	5.87	1.19	.59	21.18	9.73	4.54
Average	28,334	820 b	700 b	85	33.3 a	11.1 b	5.88 b	1.19 ab	.59	21.66 a	9.59 a	4.50 a
5 plants per hill	48,475	856	745	87	33.3	11.1	5.79	1.19	.59	21.73	9.71	4.38
1 plant per 3 inches	49,440	924	810	88	33.8	10.9	5.85	1.18	.59	20.98	9.80	4.47
Average	48,957	890 a	777 a	87	33.5 a	11.0 b	5.81 b	1.19 ab	.58	21.35 a	9.76 a	4.43 a
7 plants per hill	64,548	843	722	86	33.4	10.9	5.59	1.18	.58	21.51	9.77	4.33
1 plant per 2.1 inches	58,869	848	741	87	33.6	10.9	5.57	1.17	.58	21.25	9.71	4.40
Average	61,708	845 b	731 b	86	33.5 a	10.9 b	5.58 c	1.18 b	.58	21.38 a	9.74 a	4.36 a
9 plants per hill	75,497	823	714	87	34.1	10.8	5.46	1.17	.57	21.86	9.66	4.45
1 plant per 1.7 inches	85,574	834	727	87	33.7	10.9	5.43	1.17	.58	21.37	9.61	4.38
Average	80,535	828 b	720 b	87	33.9 a	10.8 b	5.45 c	1.17 b	.57	21.61 a	9.63 a	4.41 a
Average hill planting		805	687	85	33.3	11.0	5.76	1.19	.58	21.82	9.60	4.40
Average drill planting		831	722	87	33.4	11.1	5.77	1.19	.58	21.24	9.65	4.45

Table 2. The effect of drill and hill planting at five populations on the agronomic and fiber properties of Deltapine 16 - 1970.

	Plants per acre	Lint Per Acre Total	Lint Per Acre First pick	Lint Per Acre Percent first pick	Lint percent	Seed index	Boll size grams	Fiber Properties Length 2.5%	Fiber Properties Length 50%	Fiber Properties Stgth. gms/tex	Fiber Properties Elonga- tion	Fiber Properties Micro- naire
1 plant per hill	9,966	1308	1213	93	41.2	10.8	6.48	1.094	.537	19.17	9.15	5.43
1 plant per 15 inches	11,089	1255	1171	93	40.9	11.0	6.39	1.092	.532	19.72	9.51	5.47
Average	10,527	1281 ab	1192 a	93	41.0 a	10.9 a	6.43 a	1.093 c	.535	19.45 a	9.33 a	5.45 a
3 plants per hill	29,267	1339	1256	94	40.9	10.9	6.28	1.108	.537	20.21	9.41	5.36
1 plant per 5 inches	31,988	1282	1222	95	40.2	10.7	6.22	1.101	.527	19.47	9.47	5.15
Average	30,627	1310 a	1239 a	94.5	40.5 a	10.8 a	6.25 ab	1.105 bc	.532	19.84 a	9.44 a	5.26 b
5 plants per hill	46,368	1303	1233	95	40.0	10.9	6.22	1.122	.542	19.88	9.28	5.32
1 plant per 3 inches	50,181	1298	1233	95	39.3	10.9	6.04	1.132	.544	19.85	9.52	5.11
Average	48,274	1300 ab	1233 a	95	39.6 b	10.9 a	6.13 b	1.127 a	.543	19.87 a	9.40 a	5.22 b
7 plants per hill	61,017	1270	1205	95	39.9	11.0	6.08	1.115	.542	19.61	9.67	5.25
1 plant per 2.1 inches	66,254	1277	1214	95	38.7	11.1	6.04	1.117	.537	20.24	9.44	5.11
Average	63,635	1273 ab	1209 a	95	39.3 b	11.0 a	6.06 b	1.116 ab	.540	19.92 a	9.55 a	5.18 b
9 plants per hill	70,335	1210	1134	94	39.8	10.9	6.24	1.107	.524	19.98	9.48	5.23
1 plant per 1.7 inches	90,727	1230	1158	94	38.9	11.0	6.05	1.125	.542	19.75	9.30	5.26
Average	80,531	1220 b	1146 a	94	39.4 b	11.0 a	6.15 b	1.116 ab	.533	19.87 a	9.39 a	5.24 b
Average hill planting		1286	1208	94	40.3	10.94	6.26	1.109	.536	19.77	9.40	5.32
Average drill planting		1272	1200	94	39.6	10.97	6.15	1.115	.536	19.81	9.45	5.22

Table 3. The effect of drill and hill planting at five plant populations on the agronomic and fiber properties of Deltapine 16 at Stoneville, Miss. in 1971.

		Lint Per Acre						Fiber Properties				
	Plants			Percent			Boll	Length				
	per		First	first	Lint	Seed	size			Stgth.	Elonga-	Micro-
	acre	Total	pick	pick	percent	index	grams	2.5%	50%	gms/tex	tion	naire
1 plant per hill	10,109	1084	930	86	36.8	12.3	6.93	1.21	.58	18.97	9.72	4.69
1 plant per 15 inches	10,963	1108	928	84	36.8	12.2	6.71	1.20	.58	18.62	9.84	4.65
Average	10,536	1096 c	929 b	85	36.8 a	12.3 a	6.82 a	1.21 a	.58 a	18.80 a	9.78 a	4.67 a
3 plants per hill	29,884	1213	1054	87	36.5	12.0	6.42	1.21	.58	19.25	9.61	4.55
1 plant per 5 inches	30,421	1237	1076	87	36.6	12.0	6.54	1.21	.58	18.87	9.84	4.59
Average	30,152	1225 ab	1065 a	87	36.6 ab	12.0 b	6.48 b	1.21 a	.58 a	19.06 a	9.72 a	4.57 b
5 plant per hill	46,890	1245	1060	85	36.6	12.0	6.52	1.21	.59	18.77	9.82	4.58
1 plant per 3 inches	45,466	1230	1066	87	36.6	12.0	6.46	1.21	.57	18.78	9.35	4.54
Average	46,178	1237 a	1063 a	86	36.6 ab	12.0 b	6.49 b	1.21 a	.58 a	18.78 a	9.59 a	4.56 b
7 plants per hill	60,922	1167	1002	86	36.3	11.8	6.29	1.21	.59	18.78	9.87	4.48
1 plant per 2.1 inches	62,061	1226	1069	87	36.3	11.9	6.28	1.20	.58	18.67	9.76	4.44
Average	61,491	1196 ab	1035 a	86	36.3 b	11.8 b	6.28 c	1.21 a	.58 a	18.73 a	9.81 a	4.46 c
9 plants per hill	73,072	1158	999	86	35.9	11.7	6.27	1.20	.58	18.58	9.60	4.41
1 plant per 1.7 inches	72,060	1223	1076	88	36.4	11.8	6.26	1.21	.58	19.08	10.01	4.50
Average	72,566	1190 b	1037 a	87	36.2 b	11.8 b	6.27 c	1.21 a	.58 a	18.83 a	9.81 a	4.45 c
Average hill planting	---	1173	1009	86	36.4	12.0	6.48	1.21	.58	18.87	9.72	4.54
Average drill planting	---	1205	1043	87	36.5	12.0	6.45	1.21	.58	18.81	9.76	4.54

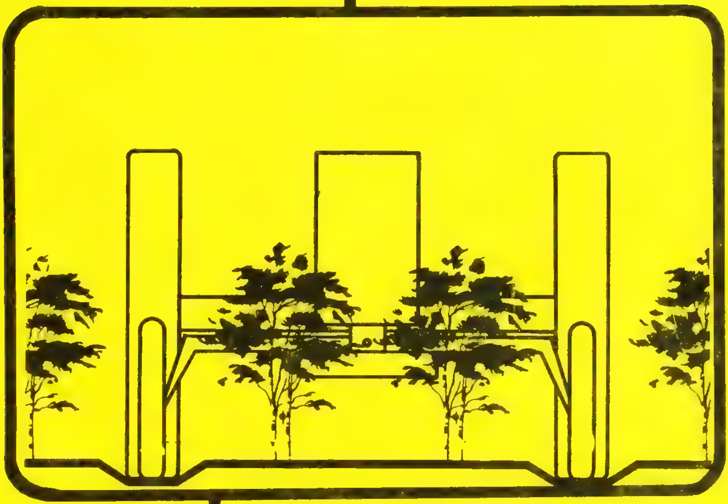
Table 4. 3-Year average (1969-71). The effect of hill and drill planting on the agronomic and fiber properties of Deltapine 16 at Stoneville, Miss.

	Plants per acre	Lint Per Acre			Lint percent	Seed index	Boll size grams	Fiber Properties				
		Total	First pick	Percent first pick				Length 2.5%	Length 50%	Stgth. gms/tex	Elonga-tion	Micro-naire
1 plant per hill	10,132	1026	905	88	36.7	11.5	6.50	1.17	.57	20.00	9.44	4.84
1 plant per 15 inches	11,123	1030	905	88	36.8	11.6	6.41	1.17	.57	19.93	9.59	4.85
Average	10,627	1028	905	88	36.8	11.6	6.45	1.17	.57	19.97	9.51	4.85
3 plants per hill	29,795	1122	998	89	37.0	11.3	6.20	1.17	.57	20.54	9.49	4.79
1 plant per 5 inches	29,626	1115	1005	90	36.7	11.3	6.21	1.17	.57	19.84	9.68	4.77
Average	29,710	1118	1001		36.8	11.3	6.21	1.17	.57	20.19	9.59	4.78
5 plants per hill	47,253	1135	1013	89	36.6	11.3	6.18	1.18	.58	20.12	9.61	4.76
1 plant per 3 inches	48,372	1151	1036	90	36.5	11.3	6.12	1.17	.57	19.87	9.56	4.71
Average	47,812	1143	1025		36.6	11.3	6.15	1.17	.57	20.00	9.58	4.74
7 plants per hill	62,174	1093	976	89	36.6	11.2	5.99	1.17	.57	19.97	9.77	4.69
1 plant per 2.1 inches	62,407	1117	1008	90	36.2	11.3	5.96	1.16	.56	20.05	9.64	4.65
Average	62,290	1105	992		36.4	11.3	5.97	1.17	.57	20.01	9.70	4.67
9 plants per hill	72,982	1064	949	89	36.6	11.2	6.00	1.16	.56	20.14	9.58	4.69
1 plant per 1.7 inches	82,803	1096	987	90	36.4	11.3	5.92	1.17	.56	20.07	9.64	4.71
Average	77,892	1080	968		36.5	11.2	5.96	1.16	.56	20.10	9.61	4.70
Average hill planting	---				36.7	11.3	6.17	1.17	.57	20.16	9.57	4.75
Average drill planting	---				36.5	11.3	6.12	1.17	.57	19.95	9.62	4.74

Bulletin [illegible]

August [illegible]

Stoneville Wide-Bed Cultural Systems



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Bulletin 805

Stoneville Wide-Bed Cultural Systems

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Stoneville Wide-Bed Cultural Systems

Rising costs for production items s h as labor, equipment, and materials c ntinue to concern cotton farmers in t Mississippi Delta. As an efficient f mer adapts new experiment station cvelopments to his own farm, he often alizes that increased costs for aterials and equipment have wiped ut the gains obtained from the im-oved technology. Declining profit is ot corrected if rising costs for some put items offset the new technology.

Advancements that result in real creases in profits are often slow in veloping. The subject to be discussed this article is the result of proximately 10 years of fundamental search, engineering, and testing at the elta Branch Experiment Station at oneville, Mississippi. Final testing is nderway and these results will be ailable for use in a practicable form by 974.

Wide-Bed Concept

Results from studies of both inimum tillage and skip-row cultural stems have led to a proposed wide-bed ultural technique that is based on one gnificant principle—that the use of ewer linear feet of row per acre could esult in substantial production savings n labor, equipment, and materials. dditional support for the proposed ultural system was provided by Dr. .W. Cooper (reference 3) in his uggestion to include "zone-tillage" or trench tillage" in the program. The ystem is an unbalanced pattern (Fig. 1) f rows planted alternately 40 inches apart and 60 inches apart (average row width is then 50 inches). This row arrangement requires only 10,455 linear feet of row per acre, compared with 13,068 feet of row per acre for conventional 40-inch spacing, or a reduction of 20 percent in the linear feet of row per acre.

If refinement of the experimental cultural system will allow cotton yields per acre to equal or exceed those obtained with conventional 40-inch row spacing (solid-planted cotton), then each operation normally performed along the row will require less time and material input per acre, and net returns can be improved. Costs of broadcast treatments that cannot be readily modified for application along the row may not be affected. These broadcast treatments would include any full-coverage tillage practice, broadcast fertilizer or herbicide application, and all aerial applications for insect control and defoliation.

The experimental cultural system was originally assigned the code name "WF" (wide-flange), which in engineering terms describes a wider, stronger structural beam than those of standard width and thickness that is capable of withstanding greater stresses. Applied to agriculture, WF could describe a similar beam, if soil can be considered to be the "beam of agriculture". In this usage, the term could denote beds wider than the standard, that support unbalanced rows, yet have greater strength—this greater strength permitting more efficient, more

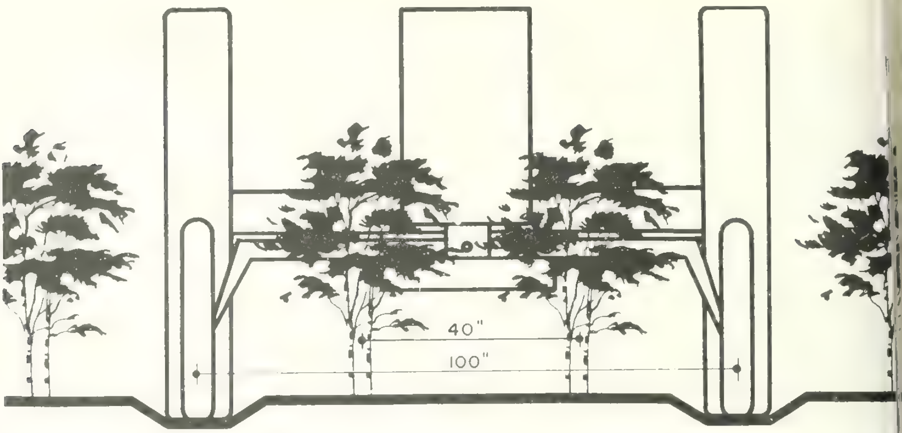


Figure 1. A transverse view of the wide-bed cultural pattern. Furrows a 100 inches apart, paired rows 40 inches apart.

economical, and more timely manipulation of soils, machines, and men in the total farm system.

Wide-Bed Research

In 1962, the first "wide-bed" treatment was evaluated at the Delta Station. This treatment was one of several evaluated in a minimum tillage study on heavy clay soils that was designed to improve drainage, tilth, and trafficability. These beds were 80 inches wide and were bounded by deep (8 to 10 inches), permanent furrows, which were often referred to as "watermelon beds" in this very early work (Fig. 2). Cotton grew well under this particular arrangement for 2 years, but no outstanding improvements were noted to offset the increased costs of establishing and maintaining the deep furrows throughout a production season. In 1963 wide beds with furrows 120 inches apart were tried. Tractors available at that time were limited in tread width adjustment to about 88 inches; consequently, all machines were forced to travel on the sloping shoulders of the bed, and not in the furrows. Tractors with wide, adjustable front-ends were used, however, to preserve untrafficked zones within the beds.

The concept of deep and permane furrows was revised into the wide-be concept, and a new research progra was initiated in the fall of 1963. Th program had as its primary objective (1) to reduce production costs and (2) t obtain yields of cotton that would equa or exceed the level being obtained wit 40-inch solid planting. Small-scale fiel plot techniques (two-row equipment 100-foot plots) were used to evaluate th wide-bed cultural system in 1965 an 1966, and again in 1970 and 1971. Th studies were expanded to include six row equipment in 1972 and 1973 Results from the studies on Bosket ver fine sandy loam in 1965 and 1966 and o Dubbs silt loam in 1970 and 1971 are shown in Table 1.

As more powerful tractors and wide cultural tools became available, objective 1, the reduction of production inputs, was readily accomplished. However, the yields per acre did not reach an acceptable level until 1971. Preliminary results of expanded studies have confirmed the probability that yields resulting from use of the wide-bed cultural system may equal or exceed the level obtained with solid-planted cotton for a given soil type. Erratic yield results suggest, however, that an optimum

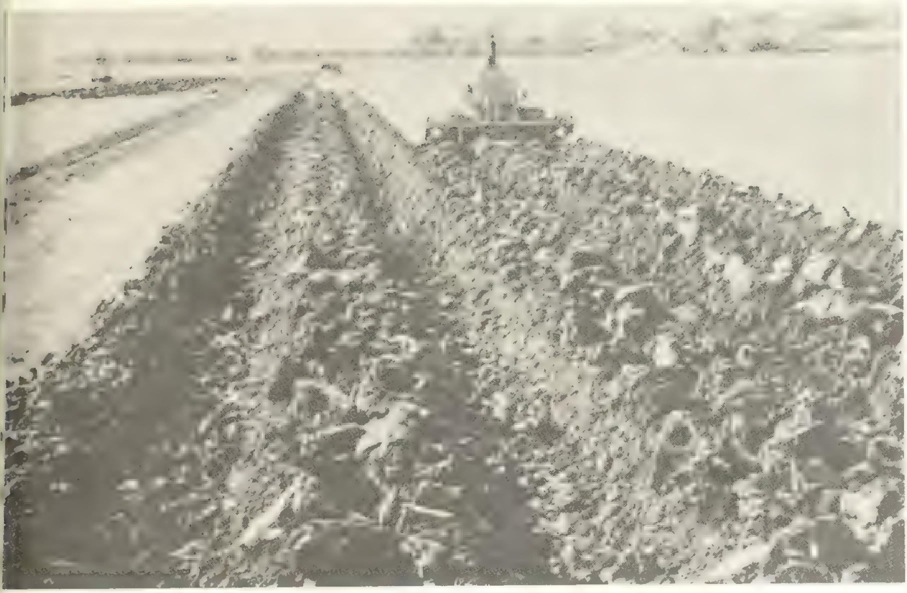


Figure 2. Preparation of "watermelon beds" on Tunica silty clay soil.

Table 1. Effect of WF cultural patterns on yield of cotton, Field 7, Delta Branch Experiment Station, Stoneville, Mississippi, 1965-66, 1970-71.

Cultural pattern	*Yield* *1965*[1]*/*	*1966*[1]*/*	*1970*[2]*/*	*1971*[2]*/*	*Average all years*
	Pounds of seed cotton per acre of land				
Conventional 40″	3,240	2,500	2,060	1,500	2,310
Wide-bed 80″	2,740	2,210	---	---	---
WF (or wide-bed) 100″	3,000	2,230	1,840	1,820	2,220

[1]/Bosket very fine sandy loam, average of 4 replications.

[2]/ Dubbs silt loam, 4 replications. Other treatments also included, but not shown.

pattern remains to be determined for each soil type. Wide-bed culture, therefore, may not always be limited to the 40-60 inch pattern.

In general, cultural recommendations for a conventional cotton program were followed in all of the years for which yield data are reported. These included subsoiling in the fall and chisel plowing once or twice in the spring, followed by bedding. Eighty to one hundred pounds of nitrogen per acre were applied at bedding in most years. A stubble mulch procedure was followed for conventional 40-inch patterns, and a modified minimum tillage program was used in the wide-bed pattern in 1971.

Although large-scale studies have not been conducted to evaluate the effects of conventional wheel tread spacings in wide beds, it is of apparent value to note that the pairs of 40-inch rows can be "straddled" with any of several standard machines, including tractors and sprayers, without undue damage to the crop. Culitvation, other tillage, and spraying operations appear to require only (1) a slightly longer toolbar or boom, (2) slightly larger sweeps in the wide-middles (see Fig. 1), and (3) a respacing of pest control apparatus.

Wider (larger) tires have also been used in conjunction with tillage studies for the wide-bed concept (Fig. 3). Objectives of research on this tillage sub-system were to improve the prime-mover floatation and traction possible under adverse field conditions. Satisfactory results in this respect would aid in increasing the number of days that field work could be done. Well-drained fields likely would not require the use of a larger tire. It has already been demonstrated that when a field is well drained a 7-to 10-day advantage is gained in possible field-working d s
following rainy periods. Wide-t
studies were discontinued in 1966 af
the success of these tires w
demonstrated in a primary tilla
program for wider beds. At this tim
soil compaction in the nontilled zon
was not considered economica
important, but the additional da
available for field work by havi
additional traction and floatation w
considered very important. The wid
spread use of dual rear tires h
generally diminished the need f
special, "wide," low-pressure tire
Both, however, are adaptable to th
wide-bed cultural system and may b
used under severe soil conditions f
either tillage, spraying, cultivating, o
harvesting operations. The wid
middles of this cultural system (Fig.
allow almost unlimited field traffic, a
needed, yet are limited enough to perm
cotton plants on good soils to produc
at maximum levels.

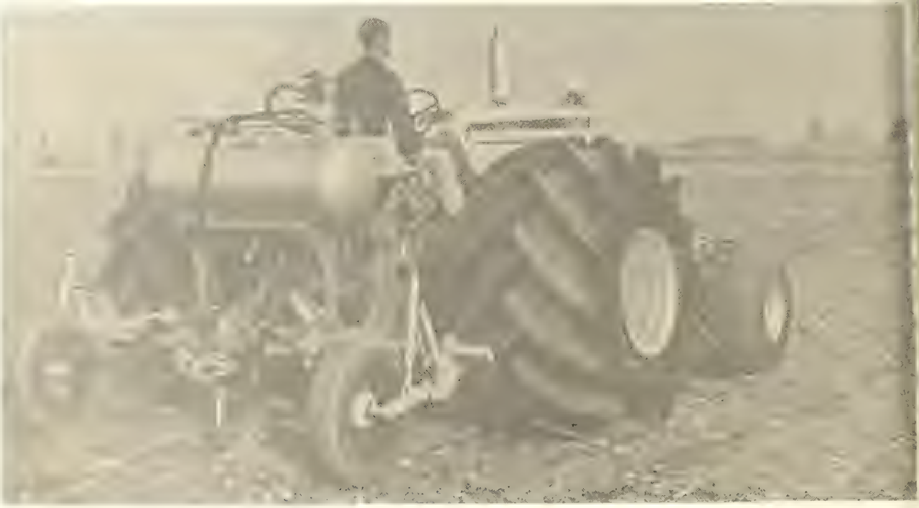
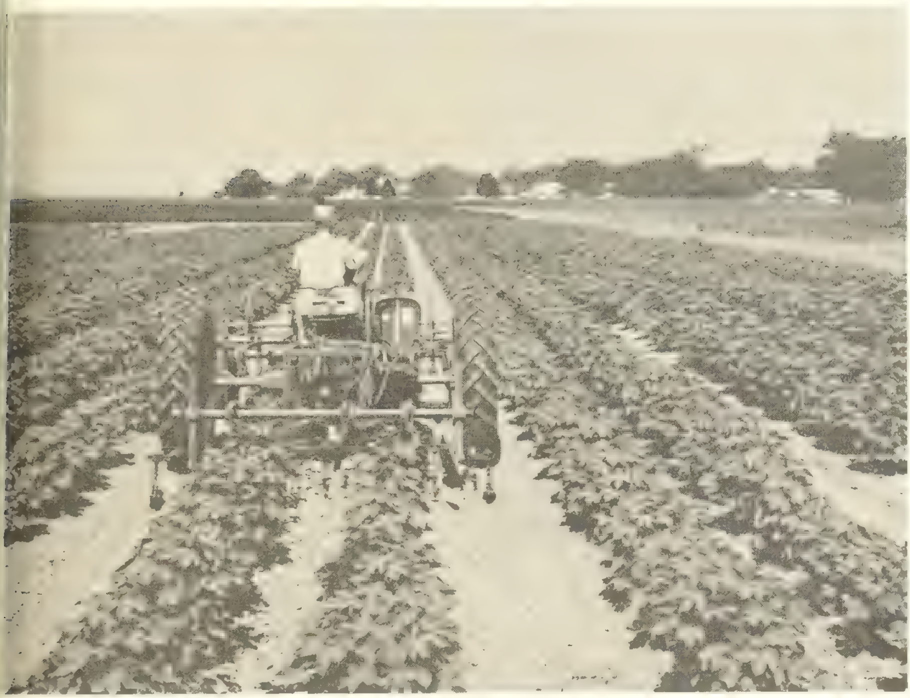


Figure 3. Large floatation-type tires used in early wide-bed studies with a 60-horsepower tractor.



igure 4. A six row plot consists of three 100-inch beds, each with two paired 0-inch rows of cotton. Here a two-row plot unit cultivates the central wide ed of a six-row plot; tractor wheels travel only in the wide middles.

It is generally agreed that onventional tapered spindle pickers erform very efficiently in harvesting igh-yield cotton, with an upper limit of apacity, in low gear, of about 4 bales er acre. The highest yield levels in the ississippi Delta as yet do not threaten he efficiency of the spindle picker, but ow yields do, because: (1) picker fficiency is reduced as yields decline nd (2) costs are about the same whether .115 pounds per foot of row (one bale er acre, 40-inch rows) is harvested or .230 pounds per foot of row (two bales er acre, 40-inch rows).

One of the objectives of wide-bed esearch at Stoneville has been to ature and harvest 25% more seed otton per linear foot of row than has een accomplished with 40-inch rows. This objective will be accomplished when wide-bed (average, 50 inches per row) yields per acre are equal those of 40-inch solid-planted cotton, or 0.144 pounds per foot of row for one bale per acre and 0.288 pounds per foot of row for two bales per acre. Skip-row patterns may also offer the advantage of greater picking efficiencies, but yields per acre generally decline with all skip-row patterns. For instance, yields on the 2 x 1 pattern average 33 percent more per planted acre, but fall short of established yields for solid-planted cotton by about 12 percent per acre.

Two-row plot-size equipment with a 60 h.p. tractor was used in these studies. This procedure allows many important principles of equipment mechanics to be investigated prior to their more costly and sometimes less accurate integration into a full-scale production system. Two-row plot results have been adjusted in the following economic analyses to reflect expected responses in systems using six- and eight-row equipment.

Research plans to develop and evaluate the full-scale wide-bed system were fully supported by Agricultural Research Service and Mississippi Agricultural and Forestry Experiment Station in 1972. Intense State-Federal cooperation to fully determine the inherent economic advantages of this cultural system is in progress. Forms of tillage and conservation programs involving soil, water, and man-made materials are receiving due attention with principles governing these areas beginning to surface.

As was indicated in the major transition from solid planted to skip-row cotton, additional constraints (adaptations necessary for proper weed control, seeding pattern, fertilizer level, harvesting and tillage program intensity) are placed on any new cultural system. None appear to be serious constraints to efficient use of a wide-bed cultural system at the present state of development, but all must be fully evaluated to avoid the ever present threat of "dollar-swapping," (or allowing economic gains over one system to be replaced by increased costs in another system.

Some Possible Economic Effects of the Stoneville Wide-bed System

The major objective of the Stoneville wide-bed system of cotton production is to reduce production costs and increase returns to cotton farmers. What effects will this system have on production costs? What effect will this system have on returns?

To examine these questions, we must look at the input costs associated with production methods which might be used to produce cotton on 100-inch beds. At present, in the Mississippi River Delta areas of Mississippi and Arkansas, three general groups of production practices are used in producing cotton on commercial cotton farms. T first group, which will be referred to "usual farm practices," is the one m commonly used on cotton farms in t Delta area of Mississippi. Table presents the inputs and costs associat with this group of practices.

A smaller group of farmers u another group of practices whi involves slightly fewer inputs and low costs, but produces yields comparab to those obtained by farmers who follc the usual farm practices. This group practices will be referred to as "more e ficient practices." Table 3 presents the inputs and associated costs.

Table 4 presents inputs and costs for third group of practices, which a similar to those in Table 3. However, th land preparation methods reflect a d velopment of the cotton System Research Group at the Delta Branch c the Mississippi Agricultural an Forestry Experiment Station. This lan preparation system has been calle modified stubble planting or limite tillage. This group of practice represents the lowest-cost system c cotton production currently recom mended in the area and is being used b few farmers. This group of practices wi be referred to as "limited tillag practices."

To analyze the impact of a 100-inch bed cotton production system, it mus be compared with present productio systems. Usual farm practices, more efficient practices, and limited tillage practices were used as inputs to develop production budgets for 100-inch beds. To develop a detailed budget for 100-inch beds, it was necessary to synthesize inputs, as the results of relatively small plot work do not permit collection of proper measurements to develop a budget.

To synthesize the inputs for the 100-inch beds, the cost of all "in-row" items such as seed, fertilizer, banded herbicides, and ground-applied insecticides were assumed to be 80% of those for 40-

Table 2. Cotton production costs per acre on sandy soils, 6-row equipment, solid planted, and usual farm practices, Delta area of Mississippi.[1]/

	Tractor costs		Equipment costs		Labor	Materials
Operation	*Direct*	*Fixed*	*Direct*	*Fixed*	*costs*	*costs*
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Row condition	0.28	0.18	0.17	0.36	0.27	---
Plant & preemerge	.28	.18	.21	.43	.54	5.63
Tractor & trailer	.10	.12	.06	.13	.40	---
Cultivate	.33	.21	.10	.18	.32	---
Poison thrips	---	---	.18	.21	.15	.34
Cultivate & postemerge	.37	.24	.14	.25	.36	.43
Cultivate & postemerge	.37	.24	.14	.25	.36	2.43
Hand weed control	---	---	---	---	5.25	---
Cultivate & postemerge	.28	.18	.10	.19	.27	1.93
Cultivate & postemerge	.28	.18	.10	.19	.27	2.43
Cultivate	.22	.14	.07	.12	.21	---
Cultivate & postemerge	.28	.18	.10	.19	.27	2.90
Hand weed control	---	---	---	---	3.75	---
Poison x 5 (ground)	---	---	.90	1.05	.75	6.50
Poison x 4 (custom air)	---	---	2.80	---	.16	5.20
Defoliate	---	---	.18	.21	.15	2.12
Harvest	---	---	7.81	12.84	2.50	---
Haul	.60	.72	.30	.78	.75	---
Harvest	---	---	4.96	8.15	1.58	---
Haul	.15	.18	.08	.19	.19	---
Cut stalks	.47	.29	.03	.09	.45	---
Subsoil	1.01	.64	.18	.27	.98	---
Chisel	.47	.29	.08	.17	.45	---

Table 2 *(continued)*

Chisel	.47	.29	.08	.17	.45	---
Disk	.22	.14	.17	.29	.21	---
Disk	.22	.14	.17	.29	.21	---
Bed	.20	.13	.11	.18	.20	---
Rebed & fertilize	.25	.16	.21	.35	.24	4.74
Totals	6.85	4.83	19.43	27.53	21.69	34.65
Total specified costs excluding ginning	$114.98					

[1/] "Crop Budgets and Planning Data for Major Farm Enterprises in the Yazoo-Mississippi Delta" by Fred T. Cooke, Jr., J. M. Anderson, and Arthur M. Heagler. Miss. Agri. and Forestry Exp. Station Bulletin 794, July 1972.

Table 3. Cotton production costs per acre on sandy soil, 6-row equipment, solid planted, and more efficient practices, Delta area of Mississippi. [1/]

Operation	*Tractor costs*		*Equipment costs*		*Labor costs*	*Materials costs*
	Direct	*Fixed*	*Direct*	*Fixed*		
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Row condition	0.28	0.18	0.17	0.36	0.27	---
Plant & preemerge	.28	.18	.21	.43	.54	4.85
Tractor & trailer	.10	.12	.06	.13	.40	---
Cultivate	.33	.21	.10	.18	.32	---
Poison thrips	---	---	.18	.21	.15	.34
Cultivate & postemerge	.37	.24	.14	.25	.36	.43
Cultivate & postemerge	.37	.24	.14	.25	.36	2.43
Hand weed control	---	---	---	---	5.25	---
Cultivate & postemerge	.28	.18	.10	.19	.27	1.93
Cultivate & postemerge	.28	.18	.10	.19	.27	.81
Hand weed control	---	---	---	---	2.75	

Table 3 *(continued)*

Poison x 5 (ground)	---	---	.90	1.05	.75	6.50
Poison x 2 (custom air)	---	---	1.40	---	.08	2.60
Defoliate	---	---	.18	.21	.15	2.12
Harvest	---	---	7.81	12.84	2.50	---
Haul	.60	.72	.30	.78	.75	---
Harvest	---	---	4.96	8.15	1.58	---
Haul	.15	.18	.08	.19	.19	---
Cut stalks	.47	.29	.03	.09	.45	---
Subsoil	1.01	.64	.18	.27	.98	---
Chisel	.47	.29	.08	.17	.45	---
Chisel	.47	.29	.08	.17	.45	---
Disk	.22	.14	.17	.29	.21	---
Bed & fertilize	.25	.16	.21	.35	.24	4.74
Totals	5.93	4.24	17.58	26.75	20.72	26.75
Total specified costs excluding ginning		$101.97				

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¹/ **"Crop Budgets and Planning Data for Major Farm Enterprises in the Yazoo-Mississippi Delta" by Fred T. Cooke, Jr., J. M. Anderson, and Arthur M. Heagler. Miss. Agri. and Forestry Exp. Station Bulletin 794, July 1972.**

Table 4. Cotton production costs per acre on a sandy soil, 6-row equipment, limited tillage, and more efficient practices, Delta area of Mississippi.[1]

Operation	*Tractor Costs* *Direct*	*Fixed*	*Equipment Costs* *Direct*	*Fixed*	*Labor Costs*	*Materials Costs*
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Row condition	0.28	0.18	0.17	0.36	0.27	---
Plant & preemerge	.28	.18	.21	.43	.54	4.85
Tractor & trailer	.10	.12	.06	.13	.40	---
Cultivate	.33	.21	.10	.18	.32	---
Poison thrips	---	---	.18	.21	.15	.34
Cultivate & postemerge	.37	.24	.14	.25	.36	.43
Cultivate & postemerge	.37	.24	.14	.25	.36	2.43
Hand weed control	---	---	---	---	6.00	---
Cultivate & postemerge	.28	.18	.10	.19	.27	1.93
Cultivate & postemerge	.28	.18	.10	.19	.27	.81
Hand weed control	---	---	---	---	3.75	---
Poison x 5 (ground)	---	---	.90	1.05	.75	6.50
Poison x 2 (custom air)	---	---	1.40	---	.08	2.60
Defoliate	---	---	.18	.21	.15	2.12
Harvest	---	---	7.81	12.84	2.50	---
Haul	.60	.72	.30	.78	.75	---
Harvest	---	---	4.96	8.15	1.58	---
Haul	.15	.18	.08	.19	.19	---
Cut stalks	.47	.29	.03	.09	.45	---
Subsoil	1.01	.64	.18	.27	.98	---
Bed	.20	.13	.11	.18	.20	---
Bed & fertilizer	.25	.16	.21	.35	.24	4.74
Totals	4.97	3.65	17.36	26.30	20.56	26.75
Totals specified costs excluding ginning			$99.59			

---

[1] **"Crop Budgets and Planning Data for Major Farm Enterprises in the Yazoo-Mississippi Delta" by Fred T. Cooke, Jr., J.M. Anderson, and Arthur M. Heagler. Miss. Agr. and Forestry Exp. Station Bulletin 794, July 1972, (referred to as stubble planting in this publication).**

Table 5. Potential cotton production costs per acre on
farm practices, Stoneville Triplex Subsoiler, Delta area of Mississippi.

Operation	Tractor costs		Equipment costs		Labor costs	Materials costs
	Direct	Fixed	Direct	Fixed		
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Row condition	0.23	0.17	0.20	0.42	0.18	---
Plant & preemerge	.19	.17	.25	.51	.36	4.50
Tractor & trailer	.08	.10	.05	.10	.32	---
Cultivate	.25	.16	.13	.24	.24	---
Poison thrips	---	---	.14	.17	.12	.27
Cultivate & postemerge	.28	.18	.15	.27	.27	.34
Cultivate & postemerge	.28	.18	.15	.27	.27	1.94
Hand weed control	---	---	---	.19	4.20	---
Cultivate & postemerge	.20	.13	.11	.19	.20	1.54
Cultivate & postemerge	.20	.13	.11	.19	.20	1.94
Cultivate	.19	.12	.10	.18	.18	---
Cultivate & postemerge	.20	.13	.11	.19	.20	2.32
Hand weed control	---	---	---	---	3.00	---
Poison x 5 (ground)	---	---	.72	.84	.60	5.20
Poison x 4 (custom air)	---	---	2.80	---	.16	5.20
Defoliate	---	---	.14	.17	.12	1.70
Harvest	---	---	6.72	10.73	2.15	---
Haul	.60	.72	.30	.78	.75	---
Harvest	---	---	4.27	7.01	1.36	---
Haul	.15	.18	.08	.19	.19	---
Cut stalks	.38	.23	.02	.07	.36	---
Subsoil	.81	.51	.14	.22	.78	---
Chisel	.47	.29	.08	.17	.45	---
Chisel	.47	.29	08	.17	.45	---

Table 5 *(continued)*

Disk	22	14	17	29	.21	---
Disk	22	14	.17	.29	.21	---
Bed	19	12	.18	.29	.18	---
Rebed & fertilize	19	12	.18	.29	.18	3.79
Totals	5 80	4 21	17.55	24 43	17.89	28.74
Total specified costs excluding ginning	$98.62					

Table 6. Potential cotton production costs per acre on sandy soil, 6- and 8-row equipment, 100-inch beds, and more efficient practices, Stoneville Triplex Subsoiler, Delta area of Mississippi.

Operation	Tractor costs Direct	Tractor costs Fixed	Equipment costs Direct	Equipment costs Fixed	Labor costs	Materials costs
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Row condition	0 23	0.17	0.20	0.42	0.18	---
Plant & preemerge	.19	.17	.25	.51	.36	3.88
Tractor & trailer	.08	.10	.05	.10	.32	---
Cultivate	.25	.16	.13	.24	.24	---
Poison thrips	---	---	.14	.17	.12	.27
Cultivate & postemerge	.28	.18	.15	.27	.27	.34
Cultivate & postemerge	.28	.18	.15	.27	.27	1.94
Hand weed control	---	---	---	---	4.20	---
Cultivate & postemerge	.20	.13	.11	.19	.20	1.54
Cultivate & postemerge	.20	.13	.11	.19	.20	.65
Hand weed control	---	---	---	---	3.00	---
Poison x 5 (ground)	---	---	.72	.84	.60	5.20
Poison x 2 (custom air)	---	---	1.40	---	.08	2 60

Defoliate	---	---	[illegible]	[illegible]	[illegible]	[illegible]
Harvest	---	---	6.72	10.73	2.15	---
Haul	.60	.72	.30	.78	.75	---
Harvest	---	---	4.27	7.01	1.36	---
Haul	.15	.18	.08	.19	.19	---
Cut stalks	.38	.23	.02	.07	.36	---
Subsoil	.81	.51	.14	.22	.78	---
Chisel	.47	.29	.08	.17	.45	---
Chisel	.47	.29	.08	.17	.45	---
Disk	.22	.14	.17	.29	.21	---
Bed & fertilize	.19	.12	.18	.29	.18	3.79
Totals	5.00	3.70	15.59	23.29	17.04	21.91
Total specified costs excluding ginning	$86.53					

Table 7. Potential cotton costs per acre on sandy soils, 6- and 8-inch row equipment, 100-inch beds, limited tillage, and more efficient practices, Stoneville Triplex Subsoiler, Delta area of Mississippi.

	Tractor costs		*Equipment costs*		*Labor*	*Materials*
Operation	*Direct*	*Fixed*	*Direct*	*Fixed*	*costs*	*costs*
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Row condition	0.23	0.17	0.20	0.42	0.18	---
Plant & preemerge	.19	.17	.25	.51	.36	3.88
Tractor & trailer	.08	.10	.05	.10	.32	---
Cultivate	.25	.16	.13	.24	.24	---
Poison thrips	---	---	.14	.17	.12	.27
Cultivate & postemerge	.28	.18	.15	.27	.27	.34
Cultivate & postemerge	.28	.18	.15	.27	.27	1.94
Hand weed control	---	---	---	---	4.80	---

Table 7 *(continued)*

Cultivate & postemerge	.20	.13	.11	.19	.20	1.54
Cultivate & postemerge	.20	.13	.11	.19	.20	.65
Hand weed control	---	---	---	---	3.00	---
Poison x 5 (ground)	---	---	.72	.84	.60	5.20
Poison x 2 (custom air)	---	---	1.40	---	.08	2.60
Defoliate	---	---	.14	.17	.12	1.70
Harvest	---	---	6.72	10.73	2.15	---
Haul	.60	.72	.30	.78	.75	---
Harvest	---	---	4.27	7.01	1.36	---
Haul	.15	.18	.08	.19	.19	---
Cut stalks	.38	.23	.02	.07	.36	---
Subsoil	.81	.51	.14	.22	.78	---
Bed	.19	.12	.18	.29	.18	---
Rebed & fertilize	.19	.12	.18	.29	.18	3.79
Totals	4.03	3.10	15.44	22.95	16.71	21.91
Total specified costs excluding ginning	$84.14					

ch rows to reflect the reduction in row gth per acre which occurs with 100-ch beds. All broadcast application sts were assumed to be the same as for -inch rows on one acre. Applicable achinery performance rates were termined by factoring 8-row equip-ent. Equipment costs were deter-ined from costs for 8-row equipment. arvesting costs were based on a 14% provement in performance of the cker, rather than 20%, to allow for rning time, dump time, and other rn-row time. All practices, except bsoiling were assumed to be the same r usual and more efficient practices on 0-inch and 100-inch beds. For limited llage, practices other than subsoiling ere assumed to be the same for both 0-inch and 100-inch beds. It was ssumed that the Stoneville Triplex ubsoiler was used for all tillage ractices on 100-inch beds. This bsoiler was developed especially for eds this width and offers a cost saving f at least $0.45 per acre for subsoiling.

With these synthesized budgets Tables 5, 6, and 7), it is possible to dentify potential cost reductions when he costs of 100-inch beds are compared vith the cost of 40-inch beds (Tables 2, , and 4). Table 8 presents summary udgets that show cost comparisons etween 40- and 100-inch beds. This table indicates that *every component* of production costs may be reduced if 100-inch beds instead of 40-inch beds are used with usual farm practices. A small portion of the reduction in production costs is attributable to the use of eight-row equipment, rather than six-row equipment, for bedding, row-conditioning, planting, cultivating, and applying post emergence herbicides. The cost reduction directly attributable to using eight-row equipment instead of six-row equipment is $1.53 per acre for usual farm practices. These cost savings assume as many hours of use for wide-bed equipment as for six-row equipment. If the hours are less, then fixed costs would increase and the magnitude of savings will be less. This saving would be smaller for more efficient practices and limited tillage practices, as fewer trips are made through the field with eight-row equipment when these practices are used. As shown in Table 8, total specified costs may be reduced $16.36, or 14.2 percent. Table 9 compares 40-inch and 100-inch beds, using more efficient practices. Total specified costs may be reduced $15.44 per acre, or 15.1 percent. Table 10 indicates a cost-saving potential when 100-inch beds are compared with 40-inch beds and limited tillage practices are used in both systems. Total speci-

Table 8. Comparison of costs per acre to produce 40- and 100-inch beds of cotton on sandy soil in the Delta area of Mississippi, using usual farm practices.

Costs	*40-inch beds*	*100-inch beds*	*Differences*
	Dollars	Dollars	Dollars
Tractor costs			
Direct	6.85	5.80	-1.05
Fixed	4.83	4.21	-.62
Equipment costs			
Direct	19.43	17.55	-1.88
Fixed	27.53	24.43	-3.10
Labor costs	21.69	17.89	-3.80
Materials costs	34.65	28.74	-5.91
Totals	114.98	98.62	-16.36

Table 9. Comparison costs per acre to produce 40- and 100-inch beds of cotto on sandy soil in the Delta area of Mississippi, using more efficient practic.

Costs	40-inch beds	100-inch beds	Differen
	Dollars	Dollars	Dolla
Tractor costs			
Direct	5.93	5.00	-.9
Fixed	4.24	3.70	-.5
Equipment costs			
Direct	17.58	15.59	-1.9
Fixed	26.75	23.29	-3.4
Labor costs	20.72	17.04	-3.6
Materials cost	26.75	21.91	-4.8
Totals	101.97	86.53	-15.4

fied costs may be reduced $15.45 per acre, or 15.5 percent. Further analysis of 100-inch beds indicates that costs could be reduced $30.84 per acre, or 26.8 percent if limited tillage practices on 100-inch beds are compared with conventional 40-inch beds and usual farm practices.

No analysis of cotton is complete unless all costs of production are included. A farmer must pay ginning costs, land charges, and general farm overhead. Table 11 presents these costs for the three groups of practices for both 40- and 100-inch beds. Yields are assumed to be 700 pounds of lint for usual and more efficient practices for both 40- and 100-inch beds. Delta area cotton yields on most cotton soils other than heavy clay generally average about 700 pounds of lint per acre. Yields of 749 pounds of lint per acre are assumed for both 40- and 100-inch beds for limited tillage practices. From total costs it is then possible to determine the cost of producing 1 pound of lint with each of the three groups of practices. The Stoneville wide-bed system would appear to reduce total production costs by 2.0 cents per pound with limited tillage practices and 2.3 cents per pound with usual farm practices. A 5.5 -cent-per-pound saving might be achieved by using limited tillage practices and 100-inch beds instead of usual farm practice and 40-inch beds. These levels of poss ble cost reductions indicate tha intensive investigation of the Stonevill wide-bed system could result in signif cant savings for cotton farmers.

The final step in comparing variou production systems is to calculate ne returns or profit from the systems bein studied. To consider returns, it i necessary to look at yields. Table indicated that 100-inch bed yields hav varied from 10.8 percent less than 40 inch row yields (1966) to 21.3 percen greater than 40-inch row yields. With the use of limited tillage in 1971, yields moved up dramatically in wide-bed tests. Preliminary analysis of 1972 yields, not yet published, are also very promising. If yields for wide beds are much lower than for 40-inch beds, then all cost savings could be lost through reduced income.

What would the possible net returns be from 1 acre of cotton, assuming a price of 26 cents a pound for lint and $50 a ton for cottonseed? Table 12 presents income, costs, and returns from 1 acre of cotton for the various practices on 40- and 100-inch beds, with two yield levels given for 100-inch beds. In this table, yields for 100-inch beds were assumed to be either 100 percent of 40-inch beds or 95 percent of 40-inch beds. No Govern-

Table 10. Comparison of costs to produce 40- and 100-inch beds of cotton on sandy soil in the Delta area of Mississippi, using limited tillage practices.

Costs	*40-inch beds*	*100-inch beds*	*Difference*
	Dollars	Dollars	Dollars
Tractor costs			
Direct	4.97	4.03	-0.94
Fixed	3.65	3.10	-.55
Equipment costs			
Direct	17.36	15.44	-1.92
Fixed	26.30	22.95	-3.35
Labor costs	20.56	16.71	-3.85
Materials costs	26.75	21.91	-4.84
Totals	99.59	84.14	-15.45

ment subsidy payments for cotton were considered in these calculations. An ncrease in income of $16.35 per acre for he wide bed over 40-inch beds appears o be possible if usual farm practices are used and yields are equal. Additional returns of $15.43 and $15.45 per acre should be possible with the use of more efficient practices and limited tillage practices, respectively, on 100-inch beds if yields equal those on 40-inch beds.

If yields from 100-inch beds are only 95 percent of those from 40-inch beds, the added returns by using 100-inch beds instead of 40-inch beds would be $7.10 per acre for usual practices, $6.15 per acre for more efficient practices, and $5.15 per acre for limited tillage practices.

At some yield below the 95 percent level, all cost savings would be cancelled by the loss of income associated with the yield reduction.

Conclusions

Yield response is the most critical factor in the evaluation of 100-inch beds. Cost reduction is usually of little value unless net incomes are held constant or increased. It is doubtful whether many farmers would adopt a practice which reduced their costs but had no effect on income if yields are reduced by that practice.

The Stoneville wide-bed cultural system offers great potential for reducing the costs of cotton production. The principal question which must be answered is whether this system will produce yields which will maintain or increase income and reduce labor requirements. Research must determine the yield responses with this system and the practices associated with those yield responses before the system can be fully evaluated.

There are many other questions which must also be answered. On what soil types are acceptable yield levels possible? Will it be necessary to vary the size of the wide middles to get acceptable yields on different soil types? What will the year-to-year yield variability be with this system when it is compared with that for 40-inch rows and the more common skip-row systems currently used by farmers?

More intensive research will facilitate the development of tools and practices which could further reduce production costs for this system and result in even greater yield response to the wide-bed production system. Certainly it would appear that some form of limited tillage production system may have its greatest impact in wide-bed cotton culture.

Table 11. Total costs of producing one acre of cotton, 40-inch and 100-inch beds, various production packages.

Item	*Specified costs*	*Ginning at $3.50, 100# lint*	*Land (1970)**	*General overhead (1970)**	*Total costs*	*Cost per pound of lint*
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
40-inch bed						
Usual practices	114.98	24.50[1]	26.99	15.86	182.33	.260
More efficient practices	101.97	24.50[1]	26.99	15.86	169.32	.242
Limited tillage practices with 7% yield response	99.59	26.22[2]	26.99	15.86	168.66	.225
100-inch bed						
Usual practices	98.62	24.50[1]	26.99	15.86	165.97	.237
More efficient practices	86.53	24.50[1]	26.99	15.86	153.88	.220
Limited tillage practices with 7% yield response	84.14	26.22[2]	26.99	15.86	153.21	.205

***"Cost of Producing Upland Cotton in 1970—An Interim Report." March 1971. USDA, ERS, FPED.**

[1] Assume 700 pounds of lint per acre.

[2] Assume 749 pounds of lint per acre.

Table 12. Costs and returns for 40- and 100-inch beds with various production practices and yield responses.[1]/

Item	*Income*			*Total costs*	*Returns*
	Cotton lint	*Cotton-seed*	*Total*		
	Dollars	Dollars	Dollars	Dollars	Dollars
40-inch beds					
Usual practices[2]/	182.00	27.48	209.48	182.33	27.15
More efficient practices[2]/	182.00	27.48	209.48	169.32	40.16
Limited tillage practices[3]/	194.74	29.40	224.14	168.66	55.48
100-inch beds					
Usual practices[2]/	182.00	27.47	209.47	165.97	43.50
More efficient practices[2]/	182.00	27.47	209.47	153.88	55.59
Limited tillage practices[3]/	194.74	29.40	224.14	153.21	70.93
100-inch beds—95% of expected yield					
Usual practices[4]/	172.90	26.10	199.00	164.75[6]/	34.25
More efficient practices[4]/	172.90	26.10	199.00	152.69[6]/	46.31
Limited tillage practices[5]/	185.12	27.93	213.05	151.92[6]/	61.13

[1]/ Lint values at 26¢ per pound and cotton seed at $50 per ton (2.5¢ per pound).

[2]/ 700 pounds lint per acre and 1,099 pounds cottonseed per acre.

[3]/ 749 pounds lint per acre and 1,176 pounds cottonseed per acre.

[4]/ 665 pounds lint per acre and 1,044 pounds cottonseed per acre.

[5]/ 712 pounds lint per acre and 1,117 pounds cottonseed per acre.

[6]/ From Table 11 with a change in ginning costs to reflect yield at 95% of those used in Table 11.

Analysis of wide-bed cotton production research clearly indicates that significant additional research inputs are justified and could lead to an excellent payoff to cotton producers.

Summary

The Stoneville wide-bed cultural system has evolved over a period of approximately 10 years. The basic principle of the wide-bed system is that there are fewer linear feet of row per acre in the wide-bed system. Therefore, the input cost of all operations associated with row application should be reduced. This system is supported by results from early tillage experiments and earlier skip-row investigations.

No improvement in yields per acre has been consistently demonstrated in small plots and was not an objective in the development of this cultural system. However, at least one year's results (1971) on Dubbs silt loam soil indicated a solid yield advantage in favor of the wide-bed pattern, or the 40 by 60 spacing of rows. In earlier studies—1965, 1966, and 1970, there was an apparent reduction in yield per acre from using this pattern. Care must be exercised in selecting the width of the wide middles, sometimes referred to as "skips." If row width is increased 25% (from an average of 40 inches to an average of 50 inches), yields per linear foot of row must be increased by a like amount to obtain the yield levels per acre obtained with 40-inch rows.

This analysis indicates that the Stoneville wide-bed system of cotton production may offer opportunities for real cost reductions in cotton production, regardless of the practices used. It also indicates that wide-bed systems coupled with limited tillage practices would have the greatest impact in reducing the cost of producing cotton. In addition to cost reduction opportunities, the Stoneville wide-bed cotton production system offers opportunities for improvement in net income if acceptable yield levels can be maintained, but further research will be necessary before the system can recommended.

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974 Crop And Fertilizer Recommendations For Mississippi

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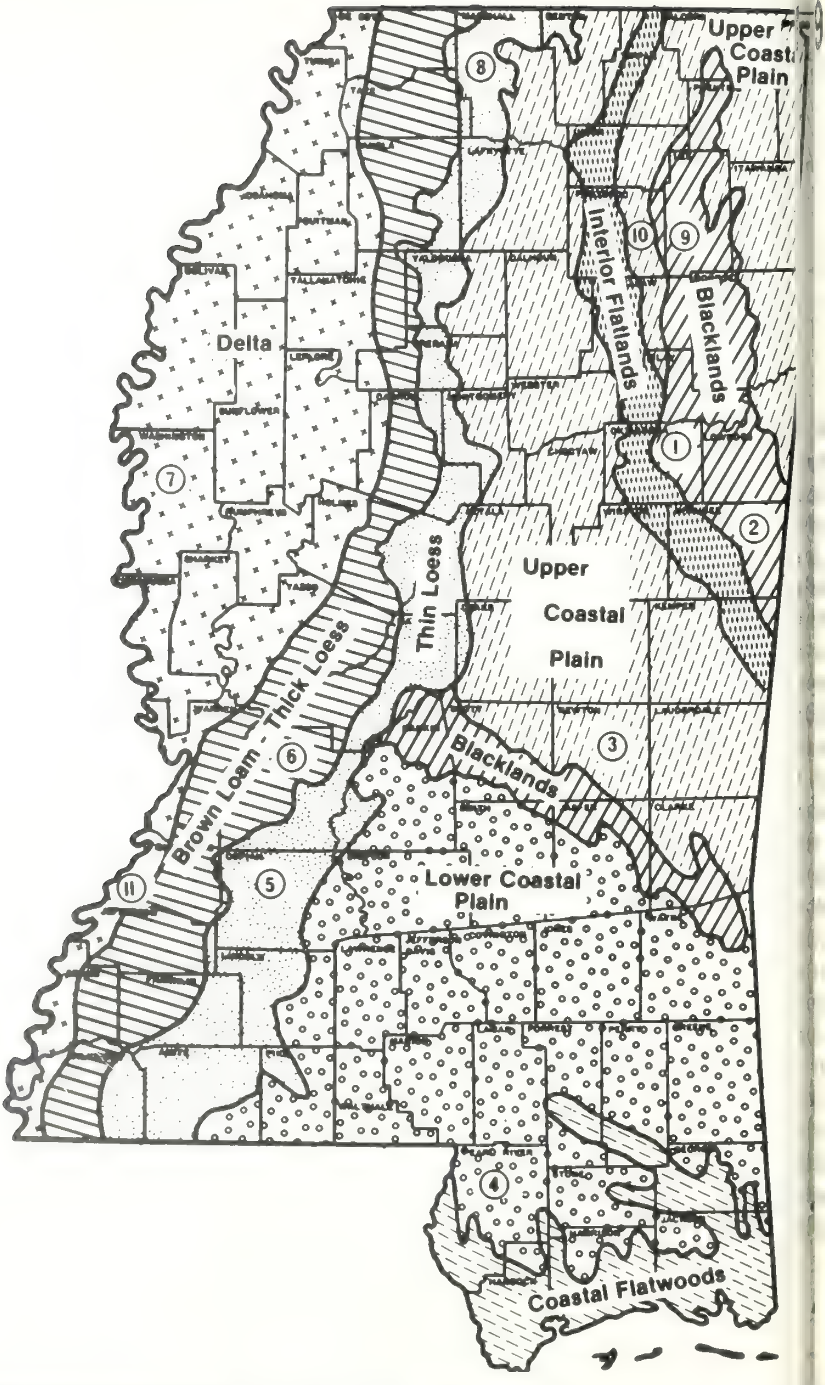
Upper Coastal Plain
Delta
Interior Flatlands
Blacklands
Thin Loess
Brown Loam - Thick Loess
Upper Coastal Plain
Blacklands
Lower Coastal Plain
Coastal Flatwoods
1
2
3
4
5
6
7
8
9
10
11

This map shows land resource areas of the state and how Experiment Statio locations fit into them. Number 1 is the central station at Miss. State. Branch statio are: 2 Brooksville, 3 Newton, 4 Poplarville, 5 Crystal Springs, 6 Raymond, 7 Stonevill 8 Holly Springs, 9 Verona, 10 Pontotoc, and 11 Alcorn.

974 Crop And Fertilizer Recommendations For Mississippi

Crop and fertilizer recommendations
made annually by the Mississippi
icultural and Forestry Experiment
tion. These recommendations incor-
ate the latest research findings at
issippi State and the Branch Experi-
t Stations. Included is information on
eties and fertilization and seeding
tices for crops commonly grown in
state, as well as information on lawns
other turf areas.

Because of varying soil and weather
ditions and other local factors, no
le crop variety or fertilizer recom-
dation is suitable for all the state;
etheless, these general recommenda-
s are useful guides for crop produc-
. Of course these recommendations
ume that other good farming practices
be followed.

If more specific information is needed,
may be obtained from the Cooperative
tension Service, the Experiment
tion, your County Agent, or other
ined agricultural workers in your
ality.

Soil Testing Service

Maximum profit is obtained from
tilizer only when the right kind and
ount are used on each field.

Through the Soil Testing Department of the Cooperative Extension Service every farmer can get this information as well as information on liming practices. Furthermore, the Soil Testing service makes recommendations for exceptionally high production goals which may not be provided for in the general recommendations.

Soil testing is a free service. Soil sample boxes, mailing cartons, and instructions for collecting samples are available in each county's office and the offices of other agricultural agencies.

Plant Nutrients

Plant nutrients may be divided into two groups: (1) Those elements used by crops in relatively large amounts, the macronutrients; and (2) those needed in very small amounts, the micronutrients.

The first group includes nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur. These are usually subdivided into the primary fertilizer nutrients – nitrogen, phosphorus, and potassium – and the secondary fertilizer nutrients – calcium, magnesium, and sulfur. The primary nutrients are applied to crops either as materials or as mixed fertilizers. A fertilizer material usually contains only one fertilizer nutrient. Some examples of fertilizer materials are listed below:

Material	*Total Nitrogen N*
Ammonium nitrate	*34 percent*
Anhydrous Ammonia	*82 percent*
Urea	*45 percent*
	Available Phosphate (P_2O_5)
Superphosphate	*18 to 20 percent*
	Available Potash (K_2O)
Muriate of potash	*60 percent*

Mixed fertilizers contain two or more of the fertilizer nutrients. Each fertilizer bag is labeled with a set of numbers to show how much of each nutrient it contains. The first number shows the percentage of nitrogen (N), the second one the percentage available phosphate (P_2O_5), and the third the percentage water-soluble potash (K_2O). One hundred pounds of a 5-10-10 fertilizer thus contains five pounds of total N, 10 lbs. of available P_2O_5, and 10 lbs. of available K_2O. Fertilizer ratio refers to the relative amounts of these nutrients. The fertilizer grade gives the guaranteed amounts of each fertilizer nutrient as a percentage. For example 8-8-8 and 10-10-10 are two different grades in a 1-1-1 ratio. Similarly 6-8-8 and 9-12-12 are two grades in a 3-4-4 ratio. Materials such as ordinary superphosphate may be labeled as 0-20-0.

At present fertilizer nutrients are either expressed as the oxide, phosphorus as phosphorus pentoxide (P_2O_5), or as the element, nitrogen as N, but there is a trend toward expressing all fertilizer nutrients on the elemental basis. Accordingly, phosphate would be expressed as (P) and potash as (K) by using the chemical symbols for phosphorus a potassium, respectively. The pr "fertilizer nutrients" expressed o elemental basis would then be show N-P-K on the fertilizer bag. Some f zers are labeled both ways to famil consumers with the new labeling t When labeled on an elemental ba 10-20-20 (N-P_2O_5-K_2O) would beco 10-8.2-16.5 (N-P-K). The conve factors for potash are: K_2O x 0.83 = ; x 1.21 + K_2O. The conversion factor phosphate are P_2O_5 x 0.436 + P; P x + P_2O_5. Only the method of labeli changed not the plant nutrient valu the fertilizer.

For the most part fertilizer rec mendations are given in this bulleti pounds of N, P_2O_5 and K_2O needed acre. Usually the farmer will hav choice of more than one fertilizer gr For example, 48 lbs. each of N, P_2O_5 K_2O may be supplied with 600 lbs 8-8-8 or 400 lbs. of 12-12-12. Since s deviation from the general recomme tion does not affect net profit greatl is not necessary to apply exactly amount of N, P_2O_5 or K_2O as indica

Both the need for and the presenc the secondary nutrients in fertilizer variable. Research has shown that su deficiency is likely to occur on soil the Hill Section when sulfur-free fer zers are used. Accordingly, sulfur recommended for crop production in area especially for cotton and legume convenient and economical way to the sulfur is to use mixed fertilizers t contain sulfur. Most solid mixed fer zers sold in Mississippi contain adequ sulfur, but most liquid mixed fertiliz do not unless special provision is m for its addition.

Scattered instances of sulfur defici cy have been observed in the Delta Ar se deficiencies have been associated h land leveling on very sandy soils that low in organic matter. Since mixed ilizers are less commonly used in this a, other sources of sulfur may be more nomical or convenient to apply. ırces of sulfur that may be used in- de gypsum, elemental sulfur, ammo- ım sulfate, and ordinary super- osphate.

Calcium and magnesium are usually lied to soils as agricultural limestone, nough a major objective of liming is to utralize soil acidity. A more complete cussion of liming is given elsewhere. soils needing magnesium but not re- ring lime, the addition of a water- uble source of magnesium to mixed tilizers is a very convenient method of plying the magnesium.

The second group of nutrients is re- red to variously as "trace elements", inor elements", and "micronutrients." ey are needed by crops in very small ounts. Included are iron, manganese, c, copper, boron, molybdenum and orine. Thus far, only three (zinc, ron, and molybdenum) of these have n found to be deficient to an appreci- le extent for crop production in ssissippi. These deficiencies have not curred on all crops and have been re- icted mostly to the Hill Section. ecific recommendations for micronu- nts are given later for crops which d them.

Solid or Liquid Fertilizers

Mixed fertilizers are available in both lid and liquid forms. Liquid fertilizers ve given, or would be expected to give cellent results in most cases, but they no more effective than many, if not ost, solid mixed fertilizers.

The inferiority of some solid mixed fertilizers to liquid mixed fertilizers and to other solids can be attributed primarily to the phosphate component of these fertilizers. Only highly water soluble phosphates are, of necessity, used in the formulation of liquid mixed fertilizers, but the water solubility as well as other characteristics of the phosphate materials in solid mixed fertilizer may vary widely. All highly water soluble phosphates are very effective fertilizers but all those of low water solubility are not.

Solid mixed fertilizers formulated with ammonium phosphates and non-ammoniated superphosphate contain a very high percentage of their phosphorus in a water-soluble form and are just as effective as liquid mixed fertilizers. Ammoniation of ordinary and concentrated superphosphates to add nitrogen during the formulation of mixed fertilizers, which is a common practice, converts some of the highly effective water-soluble mono-calcium phosphate to water-insoluble calcium phosphate some of which may be somewhat less effective for crop production. This is particularly true with ordinary superphosphate (20 percent) because of the formation of an apatite-like calcium phosphate, the quantity of which increases progressively with increasing ammoniation. In a sense new rock phosphate is formed. Consequently, mixed fertilizers formulated from highly ammoniated ordinary superphosphate are not as effective as liquid mixed fertilizers, or the high quality solids. Unfortunately, most of the phosphorus in the apatite-like phosphates formed upon ammoniation of ordinary superphosphate is determined to be "available" by the chemical method currently used for control purposes.

With the sources of phosphorus

commonly used in the formulation of mixed fertilizers in Mississippi farmers are reasonably assured of good results if 50 to 60 percent of the "available" phosphorus is also water-soluble. Some manufacturers give the water-soluble phosphorus content of their fertilizers though this is not required by law.

A substantial amount of nitrogen in liquid mixed fertilizers is derived from urea and-or ammonium nitrate. As will be indicated later, nitrogen solutions containing either urea or urea and ammonium nitrate have been much less effective for surface application to summer pastures than either solid urea or ammonium nitrate. Therefore, liquid complete fertilizers would not be expected to be as effective for summer pastures as solid complete (NPK) fertilizers.

Soil pH and Liming

Excessive soil acidity and associated factors reduce crop yields. A recent summary of soil test results by the Cooperative Extension Soil Testing Department showed that some 70 percent of the soils tested needed lime for legumes and 40 percent for non-legumes.

The degree of acidity or alkalinity of a soil is expressed by its pH; values below 7.0 indicate an acid soil, above 7.0 an alkaline soil. Soil reaction, or pH, affects the availability of some of the more important plant nutrients in the soil. Phosphate is much less available in very acid soils than in slightly acid to mildly alkaline soils. In strongly and very strongly acid soils (pH below 5.5), certain elements such as manganese and aluminum may become so available that they are toxic to plants. On the other hand micronutrients such as iron, manganese, boron and zinc rapidly become less able as the pH of the soil is incr above 6.0. This is one reason why should not be overlimed. Experienc shown that overliming injury in sissippi is very likely to be associated deficiencies of boron and zinc. In the of cotton and legumes, it is very like be due to boron deficiency and corn, and perhaps other grasses, to deficiency.

Soils with a pH of 6.0 to 7.0 are supplied with lime. If the pH is less 5.5, the soil is strongly acid and n liming. Most non-legumes grow bes soil pH values above 5.5 while legumes do best if the pH is mainta above 6.0. Alfalfa does best at soil values above 6.5.

The amount of lime required to the pH of the soil to a desired value pends both on the initial pH and the holding capacity of the soil. For soil Mississippi having a pH of 5.5 or slig below, the application of 3000 pound lime per acre to sandy loam soils, 500 6000 pounds to loam and silt loam s and 7000 to 9000 pounds to clay l and clay soils, respectively, has satis torily corrected lime deficiency legumes. Since about two-thirds of soils of the state have pH values of 5.5 above, and 95 percent above 5.0, th rates of lime would bring the pH of m of the soils of the state within the ra that is favorable for legumes. Howev some soils need more, some less, some none. Therefore, the best practic to test the soils for pH and lime requ ment and apply lime as needed to ma tain the pH within the desired range.

Lime is lost naturally from the soil crop removal and by leaching. The use acid forming sources of nitrogen and turning under of legumes as soil build elerates leaching losses. For example, 0 pounds of nitrogen from such urces as ammonium nitrate, anhydrous monia and urea will cause the loss of cium and other bases equal to about 0 pounds of lime. When applied ually at this rate, the loss would ount to one ton of lime every ten rs due to fertilizer alone. Because of se losses, soils need to be limed iodically.

Generally, on sandy loam, loam and loam soils a maintenance application 2000 to 3000 pounds of lime per acre e every five to seven years is required legumes and for non-legumes fer- tzed with nitrogen as recommended. On y loam and clay soils less frequent but ger applications are required. Although e may be needed badly on some soils non-legumes, the deficiency is not despread enough to warrant a general ommendation for rates in excess of intenance requirements for these crops the absence of a soil test. Areas going o permanent grass sod should receive initial maintenance application of e prior to establishment. Subsequent intenance applications may be applied the surface.

Except for the dark upland soils and bottom soils of the Northeast Black- nd area, maintenance application should made to soils that have not been limed ring the past five to seven years.

The principal liming materials available Mississippi are ground calcic and lomitic limestones, crushed chalk or arl from Mississippi deposits and basic g. Calcic limestones contain calcium rbonate while dolomitic limestones ntain both calcium and magnesium rbonates. Liming materials from Mis- ssippi deposits contain calcium car- nate only. Basic slag, a material containing a minimum of six percent P_2O_5 and the equivalent of about 60 percent lime should be used only where both the lime and phosphate are needed. The cost of its use as a liming material only is prohibitive.

Research has shown that all of these materials are very effective in neutralizing soil acidity providing the calcic and dolomitic limestones are finely ground. Particles not passing a 40-mesh (40-holes per linear inch) are not very effective in neutralizing soil acidity. For this reason 90 to 100 percent of calcic and dolomitic limestones should pass a 10-mesh screen and 50 percent a 100-mesh screen. Particle size is not as important in the case of chalk because it contains clay impurity which causes the particles to break down within the soil. It must be crushed fine enough, however, to be spread uniformly.

Generally, the Delta and Deep Loess soil areas are abundantly supplied with magnesium, therefore, dolomitic lime is of no advantage in these areas. In the other soil areas of the state, however, magnesium levels tend to be lower and a liming material containing considerable magnesium, such as dolomitic lime, should be used; particularly in the Northeast Blacklands.

For best results lime should be mixed thoroughly with the top six to eight inches of the soil. However, depending on the texture of the soil, a maintenance application of 1000 to 2000 pounds per acre may be made as a surface application to permanent pastures, or other permanent sods.

When to Fertilize

Following their application to the soil, fertilizers become less available to plants.

This occurs because they may be lost by leaching and volatilization or be converted to less available forms within the soil. Nitrogen is both leached and volatilized. Potassium is leached from some soils but phosphate is not. But phosphate is changed to less available forms.

Fertilizers may contain nitrate or ammonium nitrogen, or both, or other forms (urea) that are changed rather rapidly to ammonium when applied to the soil. Nitrate salts found in fertilizers and in soils are highly soluble in water and are not retained chemically by the soil. Therefore, they remain in solution and move freely with the soil water being easily leached from the root zone, particularly on sandy loams, loam and silt loam soils, or other soils where water percolates readily. Under waterlogged conditions, which are more likely in clay soils, nitrates may be changed by soil bacteria to gaseous nitrogen (denitrified) which escapes into the atmosphere. Ammonium nitrogen is not denitrified nor is it easily leached, but it does not persist for long periods. It is changed (nitrified) by soil bacteria to nitrate.

Since nitrogenous fertilizers are not held in soils for long periods they are used more efficiently for crop production when applied at or near planting time or during the growing season.

Phosphate fertilizers are not lost by leaching because they react with certain soil constituents to become only sparingly soluble in water. In acid soils the reaction is mostly with iron and aluminum but in neutral and alkaline soils calcium phosphates of very low water solubility also are formed. The soil-phosphate reaction products themselves become less available with time but the process is more rapid in acid soils, particularly at pH values below 6.0.

The formation in soils of spari soluble phosphates and their subsequ reduction in availability to plants co tively is referred to as "phosphate f tion." Because of fixation, greater ficiency generally is obtained fr annual, seasonal applications of ph phate fertilizer than from less frequen off-season applications, especially moderately to strongly acid soils. Acco ingly it is usually suggested that ph phate fertilizers be applied at or just p to planting, or near the beginning of growing period for perennial crops.

Unlike phosphate, the effectiveness potash fertilizers is not reduced grea by fixation in Mississippi soils. But th is some loss by leaching, particularly fr the more sandy soils. Where leaching significant annual, seasonal applicatio result in more efficient utilization potash than less frequent or off-seas applications. Because of uptake in exc of need and its removal in the harves crop, annual and sometimes split appli tions of potash are necessary for op mum efficiency for hay crops.

Because of rising costs and lab shortages, farmers increasingly are mo interested in greater mechanizatio custom services, and in spreading th work load to increase efficiency. One w of spreading the work load is to increa land preparation and application of f tilizers in the fall where feasible f spring-seeded crops.

Fall application of nitrogen for sprin seeded crops is not practical in Mississip but in most of the better crop land, t levels of phosphate and potash are su that recommended rates of these ferti zers may be applied in the fall with litt if any reduction in yield except on ve deep sandy soils where excessive loss potash by leaching may occur.

xcept for leaching losses, potash
ed in the fall for spring-seeded crops
d be expected to be about as effec-
as that applied in the spring. Leach-
osses are not particularly significant
lay and clay loam soils. But, as in-
ed before, leaching losses do occur
he lighter soils. Leaching losses are
ced by broadcasting the fertilizer and
taining the soil pH above 6.0 by
ig. With broadcast application on
erly limed soils, substantial losses by
ing probably would not occur ex-
on light sandy soils. Potash losses by
ing can be compensated by higher
of application which might be an
ptable alternative to spring applica-
in some cases.

How to Fertilize

o obtain maximum utilization of
lizers the two components of avail-
ty, namely chemical and positional,
st be optimized concurrently.
mical availability refers to the capa-
of the fertilizer and its soil-reaction
lucts to supply nutrients to plants.
tional availability refers to the loca-
of the fertilizer with respect to the
it roots. For example, fertilizer placed
he soil a foot or so from the row is
itionally unavailable to seedling
its.

he chemical availability of nitrogen
potassium in fertilizers usually is not
cted greatly by degree of contact with
soil. However, the effectiveness of
ily reactive phosphates is protected by
icing their contact with the soil which
vs the rate of phosphate fixation. This
be done either by band placement in
soil or by granulation of the fertilizer
he factory. Since most solid fertilizers sold in Mississippi are granulated or pelletized, method of application has a greater effect on positional than on chemical availability.

To assure effective positional availability fertilizers should be placed so as to be intercepted by plant roots at an appropriate time, or be moved to plant roots with soil water. As plants grow and extend their roots both horizontally and vertically the volume of soil from which nutrients may be absorbed is increased. Consequently, fertilizers that are positionally unavailable during early plant growth may be available later.

Phosphate does not move appreciably in soils and the movement of potash is somewhat limited, especially on soils of medium to fine texture. Therefore, these fertilizers must be placed so as to be intercepted by plant roots. For drill-seeded and row crops they should be placed in the soil deep enough to be in the moist soil where plants feed as they grow. For such crops, surface application or shallow incorporation, as by disking, would be expected to give inferior results because of poor positional availability.

Nitrogen as nitrate moves with the soil water to plant roots. Its over-all efficiency is not affected greatly by degree of concentration or its location within the root zone except that enough nitrogen should be positionally available for good growth of young plants.

Nitrogenous fertilizers applied to the surface of dry soils remain positionally unavailable for the most part until dissolved and moved down into the root zone by percolating water. Before ammonium nitrogen in fertilizers is moved down into the root zone, it must be changed (nitrified) by soil bacteria to nitrate, a process requiring two to four weeks for completion in moist soil during warm seasons. Unfavorable positional availability is avoided by applying nitrogenous fertilizers far enough in advance for the necessary transformation and movement into the root zone by rainfall to occur by the time the nitrogen is needed by the crop.

Localized concentration of immobile fertilizer nutrients, such as phosphorus and potassium, near the row or drill, as results from band application, provides a very favorable opportunity for early interception by plant roots as well as for extensive root development within the fertilized zone later, a condition which contributes to optimum fertilizer efficiency. An outstanding benefit from phosphorus is its favorable influence on the early growth and development of plants. This effect is enhanced by localized placement of fertilizer near the row.

Although maximum efficiency of phosphate and potash is usually obtained by band placement for row crops and drill-seeded crops, top yields can be obtained with broadcast application of these fertilizers. But on soils that are low to very low in phosphate and potash, higher rates are needed for broadcast than for band application to obtain the same increase in yield. This is especially true where the fertilizer is incorporated by shallow disking instead of being plowed under.

Because of accumulation from previous applications, or because of high native fertility, only a small percentage of the row cropland previously cropped to cotton and fertilized as recommended over a long period would be expected to be so low in phosphate and potash as to require an appreciable increase in the recommended rate to obtain essentially the same yields when broadcast as when banded beside the row.

A hazard of localized placement o
fertilizers near the row is salt inju
seeds and seedlings resulting in
stands and stunted growth. Since f
zer salts, such as nitrates and chlor
move mostly upward and downward
soil water rather than laterally by
fusion, salt injury can be avoide
placing the fertilizer to the side of r
than beneath the seed. The distan
separation required depends upon
kind of fertilizer and the rate of ap
tion. For recommended rates of
phate and potash and up to abou
pounds of nitrogen per acre, the
mum distance of separation shoul
three to four inches to the side of
three to four inches below the seed.
higher rates of nitrogen or potash
the horizontal and vertical dista
between seed and fertilizer should b
creased, or the fertilizer should be br
cast and plowed under.

Surface application of phosphate
potash to sod crops is more effective
for row crops. This is due in part to
development and persistence of
roots near the surface. Because it is
convenient and effective this metho
application is recommended for m
tenance fertilizers on perennial, c
growing crops.

Solid sources of nitrogen are m
more effective for surface applicatio
summer pastures than are the urea-am
nium nitrate solutions such as N-So
and uran. These solutions have range
effectiveness from 66 to 74 percen
that of solid ammonium nitrate.
solid has been equal to ammonium nit
when applied in June, but when appli
month earlier its relative value was ab
85 percent of that of ammonium nitr

Surface application of solid
should not be made to pastures or o

s in sod in the spring and summer n the soil is too wet to till or when grass is wet. If applied when either soil or grass is wet excessive loss of ogen into the atmosphere as ammonia kely to occur.

Foliar Feeding

Plants absorb and utilize nutrients lied in solution to their leaves and if a ciency exists, yields and-or quality be improved by foliar application. ause they are required in such small ounts, very dilute salt solutions of the ronutrients (trace elements) may be l quite satisfactorily as foliar sprays to ect deficiencies without injury (burn- to foliage. In some areas foliar ing of trace elements has become a ewhat standard practice in crop pro- tion. Frequently, micronutrients are lied conveniently and inexpensively g with insecticides and fungicides. A cal example is the application of on to cotton with the insecticide. However, so far, under Mississippi conditions there appears to be no need for both foliar and soil application of micronutrients where they are needed for crop production.

The primary (nitrogen, phosphorus, and potassium) and the secondary (sulfur, calcium, and magnesium) nutrients, are absorbed in relatively large quantities by crops. Thus, to supply a substantial part of the total requirement of these nutrients without burning the leaves of plants would require several applications of rather dilute solutions during the growing season. Therefore, foliar feeding of these nutrients is not as feasible as foliar feeding of the micronutrients. Increases in the yield of cotton have been obtained in Mississippi under certain conditions from foliar feeding of the primary nutrients, but it has not been shown so far to be a desirable or economical alternative to soil application of these nutrients. Therefore, foliar feeding is not now recommended routinely in lieu of or as supplement to soil application of primary and secondary plant nutrients.

RECOMMENDATIONS FOR MAJOR FIELD CROPS

CORN

Hybrid: Detailed results of hybrid trials are published annually in FES Research Highlights. Ample seed hybrids with N-cytoplasms (resistant Southern Corn Leaf Blight) should be lable for 1973 planting. Seed sold in 3 will be labeled as to type of cyto- sm and only N-cytoplasm hybrids uld be grown.

Seeding Dates and Rates and Land ection: Plant in North Mississippi from ril 1 to April 25, in North Central Mississippi from March 25 to April 20, in South Central Mississippi from March 15 to April 15, and in South Mississippi from February 25 to March 15.

Corn should be planted on deep to moderately deep soil with fair to good surface drainage. Steep, droughty, and eroded hillsides are not well suited to corn.

Stands should be adjusted to yield and generally should be within the range of 12,000 to 18,000 plants for average yields of 80 to 100 bushels per acre, increasing with the yield. A good rule of thumb is to provide approximately 150 plants for each bushel of corn. Thus, on land that will produce an average yield of 80 bushels, the stand should be 12,000 plants per acre, for 100 bushels 15,000 plants, and for 120 bushels 18,000 plants. On land well adapted to corn, yields usually will fall within the range of 80 to 120 bushels per acre under good cultural practices. However, average yield goals in excess of 100 bushels per acre generally should not be set unless supplemental irrigation is available.

Fertilization – Hill Areas: Soils of the Hill Areas generally require a complete fertilizer for corn. Soils should be limed to maintain the pH above 5.5. Occasionally, following the application of lime, zinc deficiency may be encountered, especially on soils of medium to coarse texture. When this occurs, a mixed fertilizer which contains enough zinc to give 2-3 pounds per acre should be used for two to three years. No other micronutrient deficiencies have been observed in corn.

Time: Apply all of the phosphate and potash before planting. Nitrogen may be applied before planting or in split applications: one-fourth to one-third before planting and the remainder as a side dressing by the time the corn is knee high.

Rate: Apply 120 to 210 pounds of nitrogen and 40 to 70 pounds each of phosphate (P_2O_5) and potash (K_2O) in approximately 3-1-1 ratio, but adjust the rate to the expected average yield. For an expected yield of 120 bushels per acre the rate is 210 lbs. N, 70 lbs. P_2O_5, 70 lbs. K_2O. At lower yields the rate is reduced proportionately, being 162 lbs. N, 54 lbs. P_2O_5, 54 lbs. K_2O, per acre for a 100-bushel yield and 120 lbs. N, 40 lbs. P_2O_5, 40 K_2O for one of 80 bushels. If corn is grown for silage for more than one year, double the rate of K_2O.

Method: All of the phosphate potash and up to 40 pounds of nitr per acre may be placed in a band loc three to four inches to one side and to four inches below the seed. Th maining nitrogen may be drilled at a six inches from the row, broadcas applied later as a side-dressing. All or of the nitrogen may be broadcast mixture with phosphate and potash, ever, the fertilizer should be pl down as should all broadcast applica of phosphate and potash. Preplant a cations of anhydrous ammonia shou planted at least six inches to the si and six inches below the seed.

Place side-dress applications of gen a foot or more from the row, pressure solutions and solid sources depth of four inches and anhyc ammonia at a depth of six inches. face side-dress application of solid so and nonpressure solutions is almo effective as in-soil placement.

Fertilization – Delta Area: For so this area, only nitrogen is needed ger ly for top production. Soil test for phate and potash needs.

Time: Nitrogen may be applied prior to planting or in split applica one-half at or before planting and th as a side-dressing before the corn is high.

Rate: 120 to 210 pounds of nitr per acre, increasing the rate as th pected yield increases from 80 to bushels per acre.

Method: Place preplant applicatio nitrogen six or more inches from the row, non-pressure solutions and sources at a depth of four or more ir and anhydrous ammonia at a depth inches below the level of the seed. dress applications of nitrogen shoul ed one foot or more from the row, pressure solution and solid at a depth our inches and anhydrous ammonia at pth of six inches. Surface application olid sources and non-pressure solu- s is only slightly less effective than il placement.

COTTON IN THE DELTA

arieties: Results of variety tests are ished annually in MAFES Research lights.

eeding Dates and Rates: Plant as soon April 1, as weather permits, but not old soil. Hill dropped – 16 to 22 ds of delinted seed per acre. Drilled 0 to 40 pounds of delinted seed per . Drilled for cross plowing – 60 ds of delinted seed per acre. Seed ld be of good viability.

ertilization: Delta soils usually need nitrogen for most profitable yields deficiencies of potash and phosphate occur, especially of potash. For ple it is estimated that 20 percent of sandy loam soils, 75 percent of the ly to somewhat poorly drained silt soils and 30 percent of the silty clay soils will respond profitably to sh. Except for the clays as much as ercent of the soils may need phos- e. Therefore, soils should be tested hosphate and potash needs, as well r lime. Also, sandy soils that are low rganic matter or that have been ed should be tested for sulfur needs.

ime: Apply nitrogen in the spring at rior to planting, except on sandy soils having very good to excessive nal drainage and on clayey soils with surface drainage. On such soils, split cation of nitrogen should be made, alf at or prior to planting and the rest as a side dressing preferably by mid-June. Split application of nitrogen on clays with poor surface drainage is recommended because of possible loss of nitrogen by denitrification during wet periods.

Rate: On sandy loam, loam, and silt loam soils rates from 90 to 100 pounds of nitrogen per acre are recommended for solid planted cotton and for all skip-row patterns. One hundred to 120 pounds of nitrogen per acre is recommended for the silty clay loam, silty clay, and clays for all planting pattern, except that for clays with poor surface drainage the rate should be 120 to 150 pounds of nitrogen per acre.

For cotton following soybeans or pasture sod, the nitrogen rate should be reduced 20 to 30 and 40 to 50 pounds per acre, respectively.

On soils where stalk growth is too rank, maturity too late, and boll rot is a problem because of excess nitrogen, the nitrogen rate should be reduced by 30 percent.

If phosphate and potash are applied without testing the soil, a mixed fertilizer of 1:3 P_2O_5 to K_2O ratio at a rate to give 20 pounds of P_2O_5 and 60 pounds of K_2O per acre if banded and 30 pounds of P_2O_5 and 90 pounds of K_2O if broadcast is suggested for the poorly to somewhat poorly drained silt loam soils and the silty clay loam soils. None is suggested for other soils except on the basis of a soil test.

All nitrogen fertilizer recommendations are on the basis of a planted acre regardless of the planting pattern, that is, whether skip-row or solid.

Method: Application practices for nitrogen are the same as for corn in the Delta area. Banded phosphate and potash should be placed three to four inches to one side and three to four inches below the seed. Broadcast phosphate and potash should be worked into the soil by double disking with a breading disk or plowed in with a moldboard plow.

COTTON IN HILL AREAS

Varieties: Results of variety tests are published annually in MAFES Research Highlights.

Seeding Dates and Rates: Plant between April 10 and May 10 as weather permits. Hill dropped – use 16 to 22 pounds of well delinted seed or 12 to 16 pounds of acid delinted seed per acre. Drilled – use 20 to 30 pounds of well delinted seed or 15 to 20 pounds of acid delinted seed per acre. All seed planted should be of good quality.

Fertilization: A complete fertilizer (NPK) containing sulfur and boron is needed in the Hill Sections. Fertilizers for the dark upland soils of the Northeast Blackland Area having a pH above 6.0 should contain enough water-soluble magnesium to supply at least one-half and preferably as much magnesia (MgO) as potash. On soils more acid than pH 6.0 magnesium deficiency may be corrected by applying dolomitic lime at the rate of one to two tons per acre, or as indicated by a soil test.

Enough boron is provided when the mixed fertilizer contains boron and phosphate in the proportion of 0.3 pounds to 48, respectively, or boron to phosphate ratio of 1:160. No more than 0.5 pounds of water-soluble boron should be drilled with the fertilizer.

Acid soils should be limed according to soil tests to maintain the pH above 5.5

Time: Apply the phosphate and potash and all or part of the nitrogen at or a few weeks before planting time. On deep sandy or sandy loam soils with
good to excessive internal drainage,
dress one-half to two-thirds of the n
gen for most effective results. Make
dress applications of nitrogen by
June (a week or more earlier if anhyd
ammonia is used), or at early sq
formation.

On most soils, phosphate and po
may also be applied in the fall –
section on When to Fertilize.

Rate: Apply 72 pounds of nitr
(N) and 48 pounds each phospl
(P_2O_5) and potash (K_20) per acre ex
as follows: increase the nitrogen to
pounds and the phosphate and potas
60 pounds each per acre on the dark
land soils of the Blackland Areas, an
crease the nitrogen to 90 pounds per
on the well-drained bottom and on
level to gently sloping upland soils o
Upper Coastal Plain. Excessive
growth and delayed maturity indicate
much nitrogen. Somewhat stu
growth associated with yellowish g
foliage and the early yellowing prema
shedding of the leaves indicate too
nitrogen. When these conditions are
served nitrogen rates should be adju
accordingly.

Where a skip-row planting patter
followed the rate of nitrogen per pla
acre should be the same as is rec
mended for solid cotton but the rat
phosphate and potash should be incre
to 60 pounds of each per acre whe
lower rate is recommended for s
cotton. In a 4 x 4 or 2 x 2 plan
pattern there is, of course, only one-
acre of planted cotton.

Method: Same as for corn in Hill
Delta Foot Hill Areas. Contact placen
of seed and fertilizer or placement di
ly beneath seed should be avoided.

f a preemergence herbicide is to be adcast and worked into the soil, phos- ate and potash applied broadcast uld be plowed down before the bicide is applied.

SOYBEANS

Varieties: For all areas north of U.S. hway 84 use – Hill, Mack, Forrest, cy, Davis, Lee 68, Pickett 71, mes, and Bragg (listed in order of urity).

South of U.S. Highway 84 – Bragg, ton, Coker 266A, and Hardee.

Soils: Soybeans are adapted to all ta soils and to most soils of the Hill , but lower yields may be expected droughty soils such as eroded and llow upland soils.

Seeding Dates and Rates: May 1 to e 15 except extreme South Missis- i, May 20 to June 20. Plant 40-50 nds of good seed per acre.

noculation: If not on land where a p of well nodulated soybeans has wn within the last five years, the seed uld be inoculated.

Fertilization – Delta Area: Soybeans uire no fertilizer on most Delta soils many need liming. A soil test will in- ate the need for lime as well as phos- te and potash.

n the Eastern Delta and Foothills a a molybdenum seed treatment is ded for top yields on all soils that e previously acid regardless of current status, and elsewhere in the Delta on s having a pH below 6.0. A seed treat- t of ½ oz. of sodium molybdate per , or its equivalent is recommended.

Fertilization – Hill Area: In the Hill a, phosphate and potash as well as usually are needed. Except for the dark soils of the Blackland Area of Northeast Mississippi, some 70 percent of the soils of the Hill Area need lime for top yield. In the absence of a soil test, apply a mixed fertilizer of 0-1-1 ratio that contains sulfur at a rate to give 40 to 60 lbs. each of P_2O_5 and K_2O and four to eight lbs. of sulfur per acre. The fertilizer may be banded or broadcast. If broadcast, it should be plowed-in instead of disked-in for best results. If banded the fertilizer should be placed three to four inches below the seed. Avoid contact placement with the seed as well as band placement directly beneath the seed. Most newly cleared land, as well as land in unfertilized pastures, is extremely deficient in phosphorus and the rates indicated above probably will not be adequate for most profitable yields if this land is planted to soybeans. On such land the phosphate should be increased to 80 pounds per acre for a few years by using a mixed fertilizer of 0-4-3 ratio.

Where double cropping of soybeans and wheat is practiced, the phosphate and potash recommended for both crops may be applied to either crop. The fertilizer should be broadcast and worked into the soil.

In the Hill areas a seed treatment of ½ oz. of sodium molybdate per acre, or its equivalent, is recommended for soybeans on all soils and especially on soils having a pH below 6.0.

Because of injury to the bacterial culture, the inoculant and sodium molybdate or other soluble molybdate salts, should not be premixed for more than 24 hours before being applied to seed beans that are planted immediately following treatment. Actually, the best practice is to apply the inoculant and molybdate salt separately and then mix both with the beans in the same operation.

RICE IN THE DELTA

Varieties: **Long Grain**: Bluebonnet 50, Starbonnet, Dawn and Bluebelle which mature in 150, 142, 130, and 115 days respectively. **Medium Grain**: Nova 66 and Vista which mature in 125-130 days.

Seeding Dates and Rates: Rice can be seeded from mid-April to mid-June depending upon variety. The very early varieties should not be planted until June. Seeding rate 90 to 110 pounds if drilled and 110 to 135 pounds if broadcast or water seeded.

Fertilization: Apply from 100 to 140 pounds of nitrogen per acre on old crop land. New land will probably require no nitrogen for the first one or two years. The ammonium forms of nitrogen such as ammonium sulfate and urea are recommended. Fertilizer may be applied before seeding if covered by approximately two inches of soil. Otherwise, it may be applied just before the first flood and one-half at the correct "joint state." This stage occurs when the first internode or distance between the lowest two joints is 3/4 inch for very early varieties, 1/2 inch for Starbonnet and 1 1/2 inches for other varieties. If all the nitrogen is applied before the first flood, do not drain the field but maintain a continuous flood for the entire season.

SORGHUMS FOR GRAIN, SILAGE

Varieties for Grain: DeKalb BR 64, RS 700 and Acco 1093 are bird-resistant varieties with good yield potential which have the best resistance to the leaf and stalk disease anthracnose. Anthracnose infection is unpredictable and may vary in severity from year to year. The following bird-resistant hybrids will yield well if anthracnose does not develop: Funks R 79, Penngrain BR, Funks BR 630 McNair 546.

Nonbird resistant varieties such Funks G 522, DeKalb E 57 and Acc 1090 may be damaged by birds, but much more desirable for high qua grain.

Varieties for Silage: FSIA, FS NK300, Funks 102F.

Seeding Dates and Rates: April 2 July 15. Earlier dates are preferred first harvest is made by July 25, a sec cutting can usually be made if moisture is adequate. Seed 5 to 7 lbs seed per acre in rows.

Fertilization: For comparable yi the soil fertility, the fertilizer requ ments of grain sorghum and corn quite similar except that grain sorgh apparently requires less nitrog

Soil test for Phosphate and Pot needs: Depending upon the average yi apply 80 to 130 pounds of N per a the lower rate for average yields of 6 70 bushels per acre and higher rate average yields of 100 to 120 bushels acre. For intermediate yields, in mediate rates of nitrogen are rec mended.

In the Hill Areas phosphate and pot as well as nitrogen generally are requir For average yields 50 to 60 bushels acre, apply 60 to 75 pounds of nitro (N) and 30 to 40 pounds each of ph phate (P_2O_5) and potash (K_2O) per ac For average yields of 90 to 100 bush per acre 100 to 130 pounds of N and to 60 pounds each of P_2O_5 and K_2O.

Where a stubble crop is desired, ap an additional 40 to 60 pounds of nitrog after the first crop.

Depending on soil productivi average yields can be expected to ra from 50 to 90 bushels per acre for ea ntings where proper cultural and fer- zation practices are followed. Average lds from late plantings (after July 1) uld be considerably lower.

Side-dress applications of nitrogen uld be made by the time six leaves are wing which normally occurs before sorghum is ten inches high.

For Silage: Apply as for grain, except uble the rate of potash.

Method of Application: Same as for n.

SORGHUMS FOR SYRUP

Varieties: Dale, Brandes, and Theis.

Seeding Dates and Rates: Sweet ghum in Mississippi should be planted ring the first half of May. Plant two unds of seed per acre in 40-inch rows. e best spacing averages one plant every inches in the drill or four plants every inches in hills.

Fertilization: At planting, apply 40 to pounds each of nitrogen and phosphate $_2O_5$) and potash (K_2O) per acre. No e-dressing should be applied later.

Harvesting: Sweet sorghum should be vested in the dough stage of seed velopment for the maximum yield of h quality syrup. Syrup quality is im- ved by stripping the leaves, removing heads and the top joint, and delaying ling for a week after the stalks are cut.

SUGARCANE FOR SYRUP

Varieties: C.P. 36-111 and C. P. 500. On deep, well drained soils of t texture.

Seeding Dates and Rates: Cut seed e at the top mature joint and at und level, but do not strip before nting. Plant in the Fall (October 15) at the rate of two stalks, that is, place stalks end to end with a whole stalk at the union. Plant the cane in four-foot rows on land that has been broken five to six inches deep a few weeks earlier. To protect from cold and to provide good drainage, cover the cane six to eight inches deep by forming a ridge over it so that the drainage furrows between the rows are two to four inches deeper than the cane.

Fertilization: In the spring apply 40 to 50 pounds each of nitrogen and phosphate (P_2O_5) and potash (K_2O) per acre shortly after germination of the eyes or just before regrowth from stubble. Place the fertilizer in a band so that it will be four to six inches to the side of the row and three to five inches deep after the ridges have been worked down or one to two inches deeper than the cane. Side-dress with about 30 pounds of nitrogen per acre before July. Place side-dressing nitrogen in the edge of the root zone deep enough to be in moist soil without being disturbed by subsequent cultivation.

Strip, top and cut the cane before freezing weather. Harvesting as much as a month before processing improves syrup quality and reduces "sugaring."

GRASSES, LEGUMES, AND SMALL GRAINS

Supplementary Information on Pasture Recommendations for the Hill Section.

Planting: In most instances a grass-legume mixture will provide less expensive and more nutritious pasture forage than grass alone. Therefore where practical new pastures should be planted to the desired grass plus one or more legumes. The pasture should then be fertilized to meet the needs of the legume, namely phosphorus, potash and lime as needed. Rates of these nutrients sufficient for the legume will also be adequate for the grass. The legume should provide adequate nitrogen for both species through fixation. In general, it is unwise to apply fertilizers containing nitrogen to grass-legumes mixtures.

Renovation of Grass-legume pasture: Where the stand of legumes in a pasture has degenerated to less than 15 percent or has been lost entirely, it would pay to reseed legumes. This is best done in the fall season. The pasture should be closely grazed or mowed and the clover seed broadcast or drilled along with a fertilizer containing phosphorus and potash as indicated by soil test.

Planting: If equipment is available, drill or band placement of seed and fertilizer is recommended for the establishment of all pasture and forage crops. With small-seeded legumes and grasses, care must be taken not to seed too deep. A seeding depth no more than 1/2 inch is recommended. Most plantings are made by broadcasting the seeds on the soil surface. It is advisable to cultipack the seed bed immediately before or after seeding.

Fertilization General: For established pastures, solid and liquid complete fertilizers and solid sources of nitrogen may be top-dressed. On summer grass pastures, however, the efficiency top-dressed urea-ammonium nitrate (non-pressure) solutions has been quite low compared to solid ammonium nitrate.

Because of the wide variety of soils to which these pasture recommendations will be applied, and of the extensive nature of the typical commercial livestock operation in Mississippi, particularly beef cattle, the pasture fertilizer recommendations are generally present as a range instead of a single and mo arbitrary figure.

The lower limit of the recommen tion is estimated to be sufficient for pla establishment and (1) for reasona yields of forage on soils well adapted the particular pasture crop under co sideration, (2) for periods of econom stress during which it is still necessary maintain a reasonable supply of che forage, and (3) where acreage per anim unit is not a serious limiting factor.

The upper limit of the fertilizer reco mendations should be used where the (soil type, (2) management system, (type of livestock enterprise, and (economic trend are such as to justify t considerably higher yields of forage.

Fall application of phosphorus potash to pastures is recommended these nutrients are necessary to establi forage seedlings in the fall. Howeve spring application is slightly more effe tive for spring and summer growth perennial plants and those which come in the spring. In general, fertilizers shou be applied as close as practical to the ti they are to be used by plants, therefo seasonal, annual applications are dicated in the following tables on fora and pasture crops. If phosphate a potash are applied only once in tv years, double the annual application ra

Fertilization of Grass Pastures: T yield of grass forages is greatly increas by nitrogen fertilization and, whe weather conditions do not limit growt excellent response is obtained to hi rates of nitrogen; therefore, the mo economical rate will depend up temperature, availability of moisture, a the use made of the additional forage.

Utilization of Forage: To insu maximum forage profit from fertiliz plied to pastures, livestock producers ould add additional animals to fer- zed pastures to use additional forage. **Caution**: Excessive amounts of nitro- applied in one application may result grass tetany or nitrate poisoning.

To increase the utilization of the nitro- n or to obtain a more favorable tribution of pasture production, split plications of nitrogen are recom- nded for both summer and winter ss pastures, at 60-80 pounds each time. Except for Coastal bermudagrass, ere the last application may be as late August 15, the last application of rogen to permanent summer pastures uld be made no later than July 15, d two weeks earlier if anhydrous monia is used. Because of the fre- ency of drought, mid-summer applica- ns are generally less effective than plications made in the spring and early mmer. So more nitrogen should be plied in the spring than in summer.

It may be economical to apply up to 0 pounds of nitrogen per acre to millet d sudangrass; 180 pounds to common mudagrass, dallisgrass, and bahiagrass, d 240 pounds to Coastal bermudagrass.

For summer temporary grazing crops, least 50 percent of the total nitrogen ould be incorporated into the seedbed h phosphorus and potash prior to nting. Use the remainder on the sur- e after each grazing or cutting.

Fertilization of Grass-legume Com- ations: Forage legumes may be effec- ely used to supply nitrogen required by associated grasses. When properly d, forage legumes, extend the grazing son, increase total forage production, rease forage quality and result in ter utilization of land resources. The oice of legume species and cultural ctices should be determined by when the forage is needed, availability of seed and price of seed. The application of nitrogen fertilizer to grass-legume swards will reduce the N-fixing efficiency of the legumes. Nitrogen should not be used on permanent grass-legume mixtures when legumes make up 15 percent or more of the stand.

Caution: Where conditons are especially favorable for legumes the danger of bloat may prevent full utilization of legumes seeded alone or of grass-legume combinations such as dallisgrass and white clover, particularly in the Deep Loess area. The drilling of small grains or ryegrass into such a pasture in North Mississippi orchardgrass will lessen the bloat problem and supply additional forage.

For winter growing grass-legume combinations, the legume will supply the nitrogen needed by the grass. However since grass-legume mixtures sometimes "grow off" more slowly than grass alone fertilized with nitrogen; it may be advisable to plant a portion of the winter pasture to grass alone and use nitrogen fertilizer as recommended in the tables.

Inoculation of Clovers: All seed of clovers and other forage legumes should be inoculated with the proper culture prior to planting. It is imperative that seeds of new clovers like Arrowleaf be inoculated.

Selection of Varieties: The use of certified seed will reduce the risk of bringing noxious weed seed onto the farm and result in better performance.

PEANUTS

Varieties: Spanish type – Starr, Tifspan, Spancross, Spanhoma, and Comet.

Runner type – Florunner
Virginia type – Florigiant

Growers should be sure of their market before choosing a variety or planting a marketable acreage.

Planting Dates: April 1 to May 1 in South Mississippi and April 15 to May 15 in North Mississippi.

Inoculation: Planting seed should be inoculated with the appropriate strain of *Rhizobia*, annually.

Soils and Fertilization: Well drained sandy loam soils should be selected for peanuts – heavy soil may present harvesting problems. Soils should be limed to a pH of 5.8 or higher. Soils in the Western part of the Delta area generally do not require fertilization for peanut production. In other areas of the state, broadc and plow-down 80 lb. each of phosph and potash. The fertilizer should also c tain enough boron to provide about 5 lb. per acre. A soil test is the best way determine lime and fertilizer nee Peanuts, being a legume, do not requ fertilization with nitrogen if prope inoculated. However, in some areas of Southeast, 20 to 30 pounds of nitro per acre is recommended on Span types. Peanuts should not be plan behind either soybeans or peanuts. C residues should be buried deeply plowing in the fall to aid in disease c trol. Commercial producers should ch with their county agent for more det about production practices.

CROP AND FERTILIZER RECOMMENDATIONS

Pasture or Hay Crop	Recommended Varieties	Rate of Seeding Per Acre	Time of Planting	Fertilization, lbs.-A[1/] Annual Application
Alfalfa	Cody, Delta and Florida 66	15-20 lbs.	Sept.-Nov.	Test soil for lime, Phosphorus, and potash needs.
Bermudagrass	Coastal	20 bu. sprigs.	Feb.-May[2]	150 to 240 lbs. N, 2-3 applications beginning June 1, for grazing, for hay, 300-400 lbs. N
Bermudagrass White Clover	Regal or La. S-1	2 lbs.	Plant Clover Sept.-Nov.	Test soil for lime, phosphorus, and potash needs.
Fescue and White Clover	Kentucky-31 Fescue, Regal or La. S-1 White Clover	Fescue Clover	Oct.-Nov. Feb.-May	Test soil for lime, phosphate, and potash needs.[3]
Red Clover	Orbit or Kenland	10-15 lbs. seed alone or in small grains	Sept.-Nov.	Test soil for lime, phosphate, and potash.
White Clover	Regal and La. S-1	2-3 lbs.	Sept.-Nov.	Test soil for lime, phosphate, and potash.
Arrowleaf Clover[4]	Meechee or Yuchi	12-15 lbs.	Sept.-Nov.	Test soil for lime, phosphate, and potash.
Sorghum-Sudan hybrids	Commercial Varieties	20 lbs. in rows 35 lbs. broadcast	Apr.-June	60 lbs. N prior to planting. 60 lbs. N after 1st and 2nd cutting.
Korean Lespedeza	Climax or Summit	20-25 lbs. seed in small grains	Feb.-Apr.	Test soil for lime, phosphate, and potash.
Oats	Coker 227, Nora, or Florida 501	120 lbs. for grazing 90 lbs. for grain	For grazing: early Sept. For grain mid-Oct.	Grazing: 60 lbs. N at planting and 60 lbs. in Feb. Grain: 45 to 60 lbs. N March 1-March 15

Wheat	Arthur, Arthur 71, Coker 68-15	120 lbs. for grazing 90 lbs. for grain	Same as Oats	Grazing: Same as Oats Grain: 60 to 90 lbs. N about March 1.
Rye	Explorer or Elbon	120 lbs. for grazing	Same as Oats	Same as Oats
Barley	Dayton, Harrison or Jefferson	Same as Wheat	Same as Oats	Same as Oats

1/All areas should be tested for lime, phosphorus, and potash needs.
2/If irrigated Coastal may be planted from April 1 to Sept. 1.
3/Where clover disappears in the grass-clover mixture apply 60 lbs. N in the fall.
4/Specify scarified seed.

RECOMMENDATIONS FOR PASTURES AND FORAGES IN HILL SECTIONS

Pasture or Hay Crop	Recommended Varieties	Time and Planting	Rate of Seeding Per Acre	Fertilization, lbs./A Annual Fertilization5/
ESTABLISHED WARM SEASON GRASSES (PERMANENT)				
Bahiagrass	Pensacola, Wilmington, (Argentine–South Mississippi only)	Feb.-May	20 lbs./A	120 to 180 lbs. N in split applications and 30 to 45 lbs. each of P_2O_5 and K_2O. Total application in a 4-1-1 ratio.
Bermudagrass	Common	Feb.-May	5 lbs. seed	Same as for Bahiagrass.
	Coastal	Feb.-May If irrigated plant as late as Sept. 1.	20 bu. of sprigs per acre	For Grazing: 120 to 140 lbs. N in split applications and 30 to 60 lbs. each of P_2O_5 and K_2O. Total application in 4-1-1 ratio. For Hay: 200 to 300 lbs. N in split application; 50 to 90 lbs. of P_2O_5; 100 to 180 lbs. K_2O. Total application in a 4-1-2 ratio.

Johnsongrass	Commercial	April 1 to May 15	15-25 lbs. (live seed)	Same as for Coastal Bermudagrass

ESTABLISHED COOL SEASON GRASSES (PERMANENT)

Tall Fescue	Alta, Kentucky-31, or Goar	Sept.-Nov.	15 lbs.	80 to 140 lbs. N, split fall and spring; 40 to 60 lbs. each of P_2O_5 and K_2O in a 1:1 ratio.
Orchardgrass (North Miss. only)	Potomac or Boone	Sept.-Nov.	15 lbs.	Same as Tall Fescue

5/ Established Stands. If the pasture is clipped for hay, increase the potash (K_2O) rate about 30 pounds per acre for each ton of hay.

Pasture Crop	Recommended varieties	Time of Planting	Seeding Per Acre	Fertilization, lbs./A Annual Application

Warm Season Grass-Legume Mixtures (Permanent)

Pasture Crop	Recommended varieties	Time of Planting	Seeding Per Acre	Fertilization, lbs./A Annual Application
Bahiagrass, Bermudagrass Dallisgrass with one of the following legumes.		As before	As before As before	**Establishment:** 60 to 100 lbs. of P_2O_5 and K_2O in a 1:1 ratio and 0.5 lb. of boron
White Clover	Regal or La. S-1	Sept.-Nov.	1-3 lbs.	**Maintenance:** 40 to 60 lbs. each of P_2O_5 and K_2O in a 1:1 ratio and 0.5 lb. of boron
Crimson Clover	Dixie, Chief, Autauga or Tibbee	Sept.-Nov.	25 lbs.	Same as for White Clover
Arrowleaf Clover[4]/	Meechee or Yuchi	Sept.-Nov.	10-15 lbs.	Same as for White Clover
Annual Lespedeza	Climax or Summit	Feb.-April	25 lbs.	**Establishment:** 60 lbs.

				each of P_2O_5 and K_2O in a 1:1 ratio. **Maintenance**: 40 lbs. each of P_2O_5 and K_2O.
Johnsongrass with one of the following for hay:	Commercial	Feb.-June	15-25 lbs. (live seed)	**Establishment**: 120 to 160 lbs. each of P_2O_5 and K_2O
	Florida 66, Delta, or Cody	Sept.-Nov.	15 lbs.	**Maintenance**: 60 to 80 lbs. P_2O_5 and 180 to 240 lbs. K_2O in a 1:3 ratio plus 1.0 lb. of boron.
Red Clover	Orbit, Kenland or Chesapeake	Sept.-Nov. or March-April on clean land.	10 lbs.	Same as with Alfalfa.
Rough Peas	Commercial, also known as Caley, Singletary, and Wild Winter Peas	Sept.-Oct.	30 lbs.	60 to 90 lbs. P_2O_5 and 120 to 180 lbs. K_2O in a 1:2 ratio, 120 lbs. N after peas mature.

WARM SEASON GRASSES (ANNUAL OR TEMPORARY)

Millet	All hybrid varieties	Apr.-June	15 lbs. in rows 35 lbs. broadcast	120-150 lbs. N, split application, 60 lbs. P_2O_5 and 60 lbs. K_2O.
Sorghum-Sudan Hybrids	Commercially available varieties	April-June	15 lbs. in rows 35 lbs. broadcast	120 to 180 lbs. N in split applications; 60 lbs. P_2O_5 60 lbs. K_2O.

COOL SEASON GRASS-LEGUME MIXTURES (ANNUAL OR TEMPORARY)

Annual Ryegrass with one of the following:	Gulf, Magnolia, Blends or (common in North Miss. only)	Sept.-Nov.	25 lbs.	60-100 lbs. each of P_2O_5 and K_2O in a 1:1 ratio at seeding time.
Arrowleaf Clover[4]/	Meechee or Yuchi	Sept.-Nov.	10 lbs.	

with legumes (as with ryegrass)	See wheat and oats	Sept.-Nov.	90 lbs.	
Small Grains and Legume (Use same as with ryegrass)	Oats, rye or wheat (see varieties under grass)	Sept.-Nov.	90 lbs. of small grain	Same as above.

COOL SEASON GRASS–LEGUME MIXTURES (PERMANENT)

Tall Fescue or Orchardgrass[7] (North Mississippi only) with White Clover	Alta, Kentucky 31 or Goar Commercial, Boone or Potomac Regal, or La. S-1	Sept.-Nov. Sept.-Nov. Sept.-Nov.	10 lbs. in 20" rows 10 lbs. 2-3 lbs.	**Establishment:** 60 to 100 lbs. each of P_2O_5 and K_2O in a 1:1 ratio **Maintenance:** 40 to 60 lbs. each of P_2O_5 and K_2O in a 1:1 ratio.

[7] Use of Orchardgrass in North Mississippi only.

ANNUAL COOL SEASON GRASSES AND SMALL GRAINS

Annual Ryegrass	Gulf or Magnolia (Common in North Miss. only)	Sept.-Oct.	30-40 lbs.	120 to 220 lbs. of N, split fall and spring; 80 to 100 lbs. P_2O_5 and 40 to 50 lbs. K_2O in a 2:1 ratio.
Barley (Grain only)	Harrison, (Barsoy), Jefferson, Keowee or McNair 601	Oct.-Nov.	90 lbs.	10-20 lbs. N, 30-40 lbs. each of P_2O_5 and K_2O at seeding. Topdress with 60 to 90 lbs. N about March 1.
Oats	(North) Coker 242,	For Forage:	For Forage:	Same as Ryegrass.

	Coker 227 (South) Coker 227 and Fla. 501	Sept.-Oct. For Grain: Oct.-Nov.	120 lbs. For Grain: 90 lbs.	Same as Barley, use lower rate.
Rye	Abruzzi, Balboa Elbon, Explorer, or Vitagraze	For Forage: Same as Oats For grain: Oct.-Nov.	For Forage: 120 lbs. For grain: 90 lbs.	Same as Ryegrass. Same as Barley.
Wheat	Arthur, Arthur-71, Coker 68-15	Same as for Rye	For Forage: 120 lbs. For Grain: 90 lbs.	Same as Ryegrass. 10-20 lbs. N, 40 lbs. each of P_2O_5 and K_2O at planting. Topdress with 60 to 90 lbs. N about March 1.
		LEGUMES[8]		
Alfalfa (Hay)	Florida 66, Delta, or Cody	Sept.-Nov.	15-20 lbs.	**Establishment:** 120 to 160 lbs. each of P_2O_5 and K_2O in a 1:1 ratio and 1.5 lbs. boron. **Maintenance:** 60-80 lbs. P_2O_5 and 180 to 240 lbs. K_2O in a 1:3 ratio and add 1 lb. boron.
Arrowleaf Clover[4]	Meechee or Yuchi	Sept.-Oct.	10 lbs.	60 lbs. each of P_2O_5 and K_2O in a 1:1 ratio. For seed production add 0.5 to 1.0 lb. boron.
Austrian Winter Peas	Commercial	Sept.-Oct.	50 lbs.	Same as for Arrowleaf Clover.

Lespedeza (Annual)	Climax, or Summit	Feb.-April	25 lbs.	Same as for Arrowleaf Clover.
Sericea (Perennial)	Serala, or Commercial	Feb.-June	30 lbs.	
Red Clover (Hay)	Orbit, Kenland or Chesapeake	Sept.-Nov. Mar.-Apr.	10 lbs.	**Establishment:** 60 to 100 lbs. each of P_2O_5 and K_2O in a 1:1 ratio. **Maintenance:** 50 lbs. P_2O_5 and 100 lbs. K_2O in a 1:2 ratio.
Rough Pea	Commercial–also known as Singletary, Caley and Wild Winter peas.	Sept.-Oct.	40 lbs.	Same as for Arrowleaf Clover.
Vetch	Warrior	Sept.-Oct.	30 lbs.	Same as for Arrowleaf Clover.
White Clover	Regal or La. S-1	Sept.-Nov.	2-3 lbs.	Same as for Arrowleaf Clover.

[8] All legume seed should be inoculated with the proper culture immediately before planting.

RECOMMENDATIONS FOR LAWNS AND SIMILAR TURF AREAS

Grass	Recommended Varieties	Method of Planting	Rate of Planting	Fertilization per 1000 Sq. ft. per Yr.[9]
Bahiagrass	Pensacola or Wilmington	Seed	5-10 lbs./1000 sq. ft.	6 lbs. nitrogen 2 lbs. P_2O_5 4 lbs. K_2O split into 4 applications

Bermudagrass	Common	Seed	2 lbs./1000 sq. ft.	6-9 nitrogen
	Tiflawn, Ormond, Tifway or Tifdwarf	Sprig or plug	Sprig or plug 6-12 ins. apart on 6-12 in. rows	3-4 lbs. K_2O, split into 4 applications
		Stolonize	2-5 bu./1000 sq. ft.	
Carpetgrass	Common	Seed	5 lb./1000 sq. ft.	2-3 lbs. nitrogen 1 lb. P_2O_5 1-2 lbs. K_2O, split into 2-3 applications
Centipedegrass	Common, or Oklawn	Seed or Sprig or plug	4 oz./1000 sq. ft. Sprig or plug 6-12 ins. apart on 6-12 in. rows	Same as carpet
Fescue	K-31	Seed	7-10 lbs./1000 sq. ft.	4 lbs. nitrogen (2 in fall, 2 in spring) 2 lbs. P_2O_5 and 4 lbs. K_2O
Ryegrass	Gulf or Magnolia	Overseed permanent lawns	8-10 lb./1000 sq. ft.	1 lb. nitrogen in January and March
St. Augustinegrass	Common	Sprig or plug	Sprig or plug 6-12 ins. apart on 6-12 in. rows	Same as bahia
Zoysiagrass	Emerald, Matrella, or Meyer	Sprig or plug	Sprig or plug 6 ins. apart on 6 in. rows	Same as bahia

[9]When establishing a new lawn incorporate 2-3 lbs. of N; 4-6 lbs. of P_2O_5 and 2-3 lbs. of K_2O per 1000 sq. ft. into the seedbed prior to planting.

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Bulletin 807

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Field Studies With Carbofuran For Control Of The Southwestern Corn Borer

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Introduction

The southwestern corn borer, *Diatraea grandiosella* (Dyar), is one of the major factors limiting corn production in parts of the southwestern and southeastern United States. In Mississippi, where the damage to corn is caused by the feeding of larvae of the 1st, 2nd, and 3rd generations, the heaviest losses occur in the central and northern counties. The 1st-generation larvae (from eggs laid by adults from the overwintering generation) occur in corn fields in the vicinity of Mississippi State during May through mid-June. These larvae normally pupate starting in mid-June, and emergence of moths from these pupae begins in late June and extends to mid-July. Essentially all the 1st-generation larvae complete their life cycle in the summer rather than going into diapause. The 2nd-generation larvae begin to appear in the corn about the first week in July; pupation begins about the last week of July and extends into August; and emergence occurs mostly during August. Not all 2nd-generation larvae complete their life cycle in the summer, and 10–20% usually enter diapause. The 3rd-generation larvae appear in the corn fields about the first of August and essentially all these larvae enter diapause after they have attained full size. The timing of the three summer generations at Mississippi State has not varied more than a week from year to year as observed by Henderson and Davis (4).

The feeding sites of the larvae in the corn differ with the stage of corn growth. Normally, corn plants are in the whorl stage of growth when the 1st-generation eggs are laid. Therefore when eggs hatch, the young larvae move to the whorl where they feed for 9 to 10 days before they move to the outside of the stalk and start tunneling into the stalk. If the plan is in the advanced whorl stage (tasse forming), the larvae feed on both the lea material and the immature tassel. However, larvae that feed on the immatur tassel tend to remain in the whorl severa days longer than those that feed o younger plants (Davis et. al. (1)). Sometimes these larvae may severely damag the growing point of the plants whic causes "dead heart." Dead heart plant may die or be so stunted that the plant are unproductive. Figures 1–3 show lea feeding, dead heart, and stalk tunneling

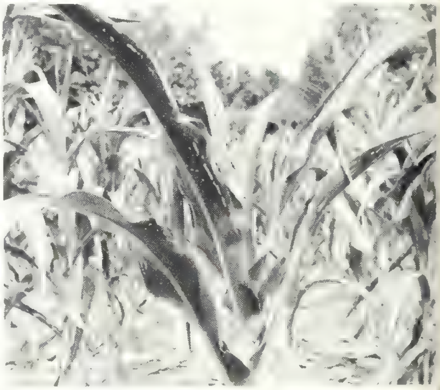

Fig. 1 Leaf feeding damage.

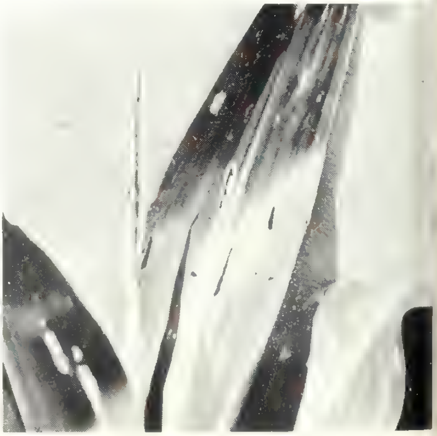

Fig. 2 Dead heart damage.

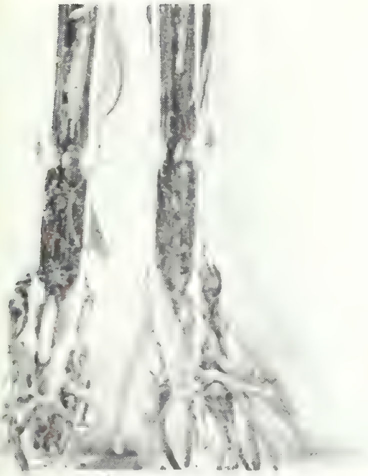

Fig. 3 Stalk tunneling.

Larvae of the 2nd generation normally e present when both stages of corn owth (whorl and tassel) are available. owever, by the time the 3rd-generation rvae occur, most of the corn has tas- led. When an infestation occurs during e tasseling stage, the larvae feed mostly the primary and secondary ears, the ung larvae feed between the husks; der larvae feed on the kernels, cob, and r shank before they move down the alk to bore in and tunnel. Also, larvae at are preparing to go into diapause ten girdle the stalks a few inches above ound level by cutting a V-shaped notch ound the inside of the stalk (Fig. 4).

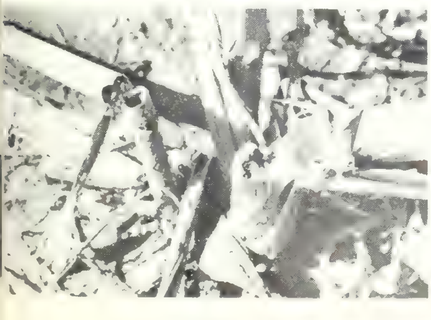

Fig. 4 Girdled stalk.

This girdling weakens the stalks, and they often fall to the ground. Ears from such plants cannot be harvested by mechanical harvesters, and these ears are subject to damage by rodents and disease organisms. Girdling, there, usually causes rather obvious and severe reductions in yield.

The recommended method of controlling the southwestern corn borer is to plant corn early enough so the corn does not sustain heavy damage by the 2nd and 3rd-generation larvae. However, in Mississippi in many of our better corn producing areas, e.g., bottom lands, early planting is impossible because of inclement weather. Thus, if losses due to the southwestern corn borer are to be reduced, other methods of control must be considered.

Carbofuran (trade name–Furadan®) is a carbamate insecticide that has been reported by several researchers to have promise for controlling the southwestern corn borer. For example, Whitcomb et al. (9) found carbofuran (1 lb AI/acre) applied in a 6-in.-wide band at planting effectively controlled 2nd-and 3rd-generation southwestern corn borers in Arkansas and significantly increased the yield of corn. Keaster and Fairchild (7) found that split application of carbofuran (1.5 lbs AI/acre at planting in the seed furrow and 1.5 lbs AI/acre as a side dress) was the most effective treatment against southwestern corn borers in Missouri. Pless and Duck (8) obtained variable results in Tennessee when they used carbofuran as a systemic insecticide, but they obtained significant control of the southwestern corn borers with foliar applications applied at various times during the season. Henderson and Davis (5) found carbofuran to be as effective as endrin in Mississippi, in reducing the insect's damage to corn when foliar applications of granules or sprays (0.5 lb AI/acre per application – 2 applications per generation) were timed with moth flights. Also, Keaster (6) stated that in-furrow treatment of carbofuran (1.5 or 2 lbs AI/acre) in southeastern Missouri at planting plus an additional granular application of carbofuran to the foliage was beneficial in further reduction of girdling and increased yield. Harding et al. (3) found carbofuran to be as effective as 1 lb AI/acre of DDT when both insecticides were applied as foliar sprays or granules for control of the European corn borer. Edwards and Berry (2) showed that carbofuran applied as a systemic gave satisfactory control of the European corn borer, *Ostrinia nubilalis* (Hubner).

Our objective in the present tests was therefore to compare the effectiveness for control of the southwestern corn borer of carbofuran applied as a systemic (various rates per acre at planting time) with carbofuran applied as a foliar spray during the 1st- and 2nd-generation moth flights. Also, we wanted to know what effect measures designed for the cont of the southwestern corn borer wou have on the European corn borer, important leaf feeder and stem borer the northern tier of Mississippi counti

Methods and Materials

The experiments were set up in randomized complete block design wit replications. Each plot consisted of rows (2 treated rows and 2 untreat border rows) ca. 90 ft long at Mississip State (Plant Science Farm) and 150 long at Holly Springs (North Mississip Branch Experiment Station). The plan ing, done the last week of May at bo locations, was purposely delayed simulate late plantings. At Mississip State, Pioneer Brand 309B hybrid w planted in 1970, and Funk G-4761 w planted in 1971 and 1972. Fun G-795W-1 and Funks G-4761 we planted at Holly Springs in 1970 a 1971, respectively.

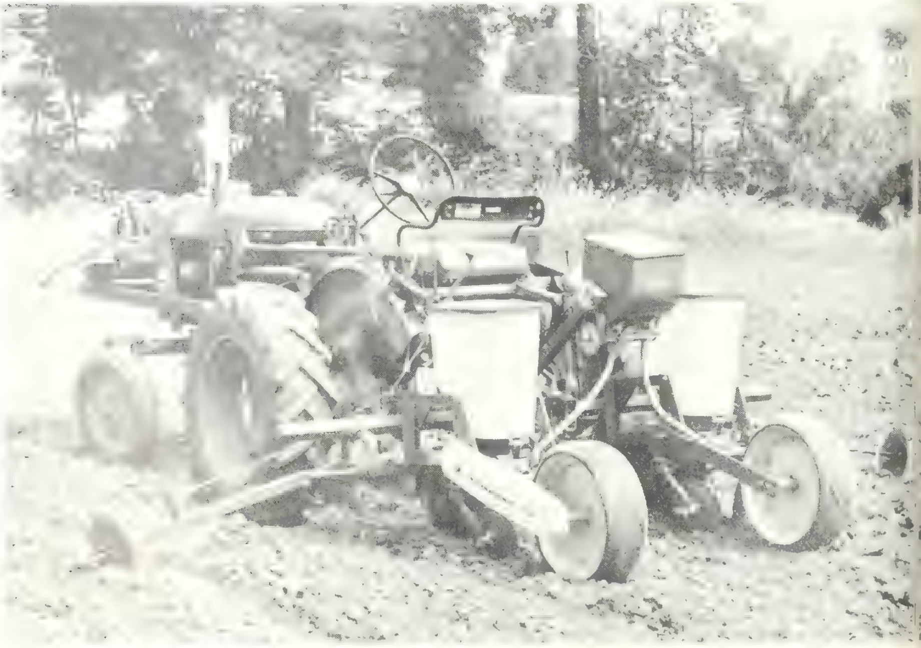

Fig. 5 Systemic applicator.

The in-furrow treatments with 10% granular carbofuran at planting were applied with a granular applicator mounted to the rear of a tractor (Fig. 5). The foliar applications of granules (5 or 0%) were applied with a Hahn Hi-Boy® Fig. 6) by mounting a granular applicaor on the rear so the granules were deivered through a baffle over the tops of he plants. The foliar applications of lowable 4F spray were applied through 4 nozzles (16 gallons of water + toxicant per acre), two on each side of the row. For corn in the whorl stage, the spray was directed into the whorl; for corn that had asseled, the nozzles were directed to the ear zone.

Timing of the foliar applications at each location was arranged to coincide with the emergence of the adult southwestern corn borers of the 1st and 2nd generations, in the early planted corn fields that were adjacent to the test plots. Thus, 10 or more plants of the early corn infested with southwestern corn borers were dissected each week, and the 1st application of spray was applied to the test plots 1 week after the 1st empty pupal case of a given generation was found; the 2nd application was made 7–10 days after the 1st application. (In 1972, the mid-generation applications were made 10–12 days after 1st moth emergence was recorded.)

The effectiveness of treatment against 2nd-generation southwestern corn borers at Mississippi State was determined by examining 50 plants (25 consecutive plants per treated row) for entrance holes into the stalks. At Holly Springs, the technique was adjusted because of the presence of the European corn borer. There a total of 10 plants per plot per replication (5 consecutive plants/treated row) were dissected and recorded as infested if it contained a larva(e), pupa(e),

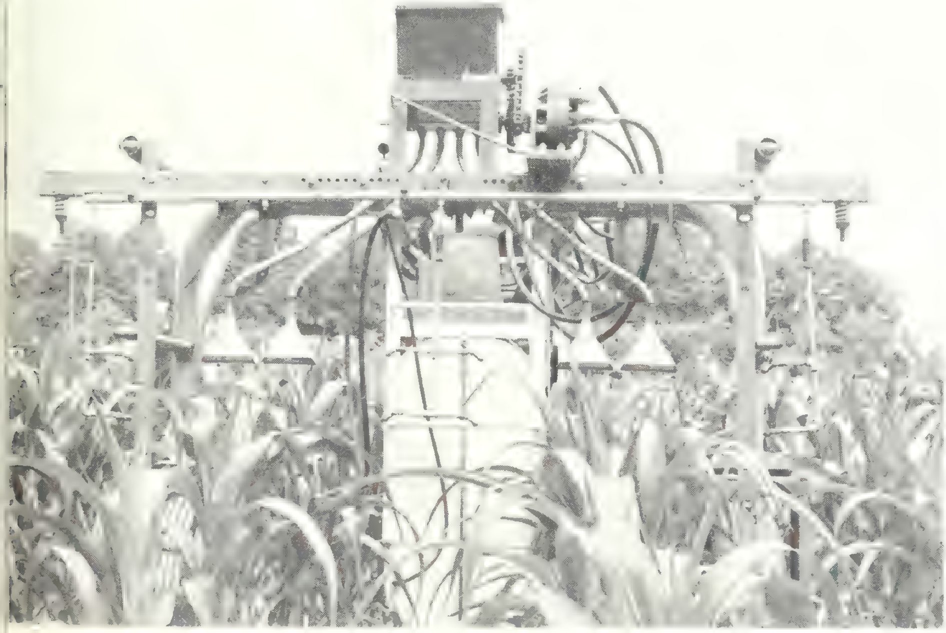

Fig. 6 Foliar applicator.

or pupal case(s) of either borer, the southwestern or European corn borer. These data were recorded during the emergence of the 2nd-generation southwestern corn borer moths, which usually occurred in early August.

Also, the effectiveness of treatment was determined at harvest by the following criteria: (1) grain yield in bushels/acre (corn was harvested from 50 ft or row from each of the treated rows except for plants that had been girdled by the southwestern corn borer and were on the ground) (2) percentage infested plants – 50 plants per replication were dissected (25 consecutive plants per treated row), and (3) percentage girdled plants – 50 plants per replication were examined (25 consecutive plants per treated row).

Results:

The results of the field studies are discussed by year and location. The data are summarized in Tables 1 and 2.

1970 – In 1970, at Mississippi State, the in-furrow treatments of carbofuran (2, 3, and 4 lbs AI/acre) significantly decreased the percentage of the plants infested with southwestern corn borers at mid-season. Unfortunately, we were unable to obtain harvest data from this location because the corn plants were killed prematurely by a severe attack of southern corn leaf blight. At Holly Springs, the in-furrow treatments (at mid-season) were highly effective in reducing the percentage of plants infested with southwestern corn borers, and the rates of 3 and 4 lbs AI/acre significantly reduced the number of plants infested with the European corn borer. At harvest, at Holly Springs, the in-furrow treatments significantly increased the yields of corn (by 15 to 19 bu/acre) over the untreated check. Also, the in-furrow treatments reduced the percentage of plants infested and girdled b the southwestern corn borer. They wei not effective in reducing the percentag of plants infested by the European cor borer.

1971 – In 1971, all treatments (i furrow and foliar) at Mississippi State r duced the percentage of plants infeste with southwestern corn borers at mi season. At harvest, only the foliar trea ments reduced the percentage of infeste and girdled plants. Yield did not diff between treatments.

At Holly Springs all treatments mid-season, except for 1 lb AI/acre i furrow, significantly reduced the percen age of plants infested with southweste corn borers, but only the foliar trea ments significantly reduced the percen age infested with European corn bore Likewise, all treatments except 1 AI/acre in-furrow significantly increase yield (18 to 34 bu/acre) compared wi the check. The foliar treatments and 3 l AI/acre in-furrow had the greatest effe on percentage of plants infested a girdled by the southwestern corn bore Treatments with 1 and 2 lbs AI/acre i furrow were less effective but were sig ficantly different from the check trea ment. The only treatments that signi cantly reduced the percentage of plan infested with European corn borers harvest were the foliar treatments.

1972 – In 1972, all treatments signi cantly reduced the percentage of plan infested with southwestern corn borer, mid-season. No significant differenc were apparent between treatments yield or in percentage of plants girdled l the southwestern corn borer.

The in-furrow treatment with 2 l AI/acre plus 2 foliar applications of gra ules and the foliar treatments wi granules were the only 2 treatments th significantly reduced the percenta

March 1974

Mississippi Cotton Variety Test For 1973

Hill Section: By A. G. Douglas
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Bulletin 812

MISSISSIPPI
COTTON VARIETY TESTS
FOR 1973

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MISSISSIPPI AGRICULTURAL & FORESTRY EXPERIMENT STATION

MISSISSIPPI STATE UNIVERSITY

March 1974

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MISSISSIPPI COTTON VARIETY TESTS FOR 1973

Delta Section

The evaluation of cotton varieties is a continuous process because improved varieties are released, cultural practices are altered, and new types are developed. Continued testing and evaluation of varieties and experimental strains are essential in providing a guide for farmers interested in the best adapted varieties having the highest possible yield and quality for their respective areas of interest. A major factor in the yield and quality of the harvested cotton crop is the variety of cotton planted. Therefore, each year the Delta Branch Experiment Station tests promising varieties and strains in different sections of the Delta.

Cotton variety tests were conducted by the Delta Branch Experiment Station in 1973 at: the Delta Station at Stoneville, Schaefer Plantation near Yazoo City, Mitchner Plantation near Sumner, and Arnold Farms near Tunica. Variety tests were conducted on two test sites at Stoneville. One was on a Bosket very fine sandy loam and another on a Sharkey clay type soil.

Fifteen varieties were grown on three of the test sites and two additional varieties were grown at Stoneville and Tunica. Varieties grown at Stoneville and Tunica were included in a cooperative, Regional variety testing program. Four entries were tested for the first time at all locations. These were Coker 312, DES 21326-04, DES 2134-13, and DES 89-11-10.

Results are reported for each location for the 1973 variety test. Yield data were based on the weight of cotton harvested from two-row plots. Each entry was randomized and replicated six times. Lint percentages and fiber property determinations were obtained from hand-picked samples. Fiber property data were determined by the U. S. Cotton Fiber Laboratory of the Agriculture Research Service, U. S. Department of Agriculture, Knoxville, Tennessee.

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Performance data of varieties tested in 1973 at individual locations are presented in Tables 1 through 5. Table 6 shows the average performance of 15 varieties grown at five locations in 1973. Table 7 shows the average performance of varieties grown at five locations over a 2-year period (1972-

73).

Table 1 shows the results of the variety test conducted on a Bosket very fine sandy loam soil at Stoneville. This test was planted on May 1 and good stands were obtained. The crop matured relatively early and the first harvest was made on September 24. Yields ranged from 644 to 1,002 pounds of lint per acre.

Table 2 gives the results of the variety test conducted on a Dundee silt loam soil at Sumner. This test was planted on May 10, which is about ten days later than normal. An adequate amount of moisture was available throughout the summer and high lint yields per acre were obtained. The crop, even though planted later than usual, matured satisfactorily, as 88 to 95% of the total crop was harvested on October 22. Yields at Sumner ranged from 1,259 to 1,539 pounds of lint per acre.

Results at Stoneville on a Sharkey clay soil are presented in Table 3. Yields on this site were relatively high for this soil type. Lint yields ranged from 758 to 901 pounds per acre. This test was planted on May 1, which is ten days to two weeks later than normal. The plants at this site were much shorter than those at other locations and many bolls were set very close to the ground.

Table 4 gives the results of the variety test at Yazoo City. This test site was planted on April 30 and lint yields ranged from 756 to 984 pounds per acre. Due to early maturity, this test was harvested only once with approximately 100% of the crop being harvested on October 3. This location usually grows a smaller plant that matures earlier because it is usually subjected to a drought stress at a much earlier date.

Results at Tunica are presented i Table 5. Lint yields ranged from 54 to 932 pounds per acre. Due to we weather conditions this test was no planted until May 14. Late plantin and rains throughout the growin season caused late fruiting and th crop matured very slowly. The tes was harvested only once on Octobe 30, with the intention of making a later harvest. However, the late maturing bolls did not open due to frost. This condition possibl lowered the yield of some of the later maturing varieties, but it wa the only test that was damaged by freeze. The second harvest wa made at all other locations before freeze occurred.

The average performance of 1 varieties grown at five locations i 1973 is presented in Table 6. DES 21326-04, Stoneville 213, and Deltapine 5916-65 were the highest-yielding varieties when average over all test environments in 1973.

The average performance of 11 varieties grown at five locations for a 2-year period (1972-73) is presented in Table 7.

The average performance of eight cotton varieties at five locations over a 4-year period (1970-73) is presented in Table 8. The combined analysis of these data showed the presence of significant variety × year and variety × location × year interactions for lint yield. The presence of these significant interactions indicated that varieties showed a differential response when grown in different environments. The lack of a significant variety × location interaction for lint yield indicated that locations had no consistent effect on differential variety response.

Tables 9 and 10 show the average

nt yield of cotton varieties grown at ve locations for different years. able 9 indicates that the highest lint ields at Stoneville are obtained rom Deltapine 25. The highest ields at Yazoo City are obtained from Stoneville 213 and Deltapine 25. The results from Tunica and Sumner indicate that approximately equal lint yields are obtained from six varieties.

Table 1. 1973 Cotton Variety Test - Stoneville, Mississippi*

	LINT PER ACRE						FIBER PROPERTIES				
			%			Boll	Length				
	Total	First pick	first pick	Lint %	Seed index	size grams	2.5%	50%	Strength g/tex	Elonga- tion	Micro- naire
	(lb)	(lb)									
DES 21326-04	1002	917	92	35.0	10.9	5.22	1.19	.55	19.74	5.81	4.06
Deltapine 25	980	799	82	38.4	11.0	5.56	1.15	.55	20.67	6.59	4.70
Deltapine 5916-65	967	819	85	37.2	11.1	6.02	1.18	.57	20.60	8.35	5.00
Stoneville 213	966	817	85	36.3	11.5	5.63	1.13	.53	20.17	6.72	4.52
Deltapine 652-679	956	810	85	38.3	10.3	5.57	1.18	.56	20.87	7.30	4.36
Deltapine 16	948	758	80	36.9	11.9	6.14	1.15	.55	21.18	8.02	4.66
Coker 310	947	747	79	38.6	11.7	5.88	1.22	.56	21.17	6.13	4.57
Stoneville 7A	943	796	84	36.8	11.1	5.71	1.14	.53	19.34	5.07	4.62
Coker 312	938	781	83	37.0	11.7	5.80	1.19	.55	21.00	6.09	4.43
Des 2134-13	924	776	84	35.2	11.2	5.20	1.16	.52	21.02	6.65	4.23
Deltapine 45A	921	774	84	37.1	12.4	5.97	1.13	.56	20.19	7.32	4.62
Stoneville 603	919	785	85	35.2	12.0	5.34	1.11	.53	20.07	6.69	4.39
DES 89-11-10	891	686	77	36.1	11.9	5.33	1.21	.56	21.39	6.46	4.47
Delcott 277	878	777	88	35.9	13.1	6.75	1.20	.55	20.43	8.27	4.06
Coker 5110	833	692	83	35.5	12.1	6.31	1.21	.57	20.87	7.31	4.14
Acala 1517-70	662	521	79	34.5	12.7	5.49	1.16	.55	24.38	5.48	4.07
Lockett 4789A	644	509	79	33.4	13.5	6.75	1.14	.54	19.77	6.25	4.26
C.V.	8.4	8.9									
LSD .05	86	78									
LSD .01	114	103									

Planted: May 1, 1973
Harvested: September 24 and October 19, 1973
***Soil: Bosket very fine sandy loam**

Table 2. Results of 1973 Cotton Variety Test - Sumner, Mississippi

	LINT PER ACRE						FIBER PROPERTIES				
			%			Boll	Length				
	Total	First pick	first pick	Lint %	Seed index	size grams	2.5%	50%	Strength g tex	Elongation	Micronaire
	(lb)	(lb)									
Deltapine 5916-65	1539	1395	91	40.9	10.2	5.74	1.18	.60	18.65	9.16	5.18
Coker 310	1511	1417	94	41.1	11.0	5.50	1.25	.60	18.26	7.38	4.77
Deltapine 16	1442	1337	93	39.3	11.4	6.47	1.21	.60	18.09	9.53	4.87
Stoneville 603	1438	1339	93	36.4	12.1	5.94	1.15	.55	18.17	8.39	4.53
Stoneville 213	1430	1323	93	38.5	11.7	5.75	1.15	.56	17.23	7.83	4.43
Deltapine 652-679	1426	1324	93	41.2	10.4	5.51	1.16	.55	18.16	7.82	4.83
Deltapine 45A	1417	1268	89	40.1	11.4	6.13	1.14	.57	17.80	8.39	4.71
Deltapine 25	1415	1240	88	40.8	10.9	6.21	1.16	.57	18.63	7.67	5.07
DES 21326-04	1407	1332	95	37.1	10.7	4.98	1.21	.58	18.40	7.80	4.41
DES 89-11-10	1407	1305	93	39.1	12.2	5.59	1.21	.58	18.35	6.55	4.83
Coker 312	1407	1340	95	40.9	11.2	5.68	1.23	.58	18.46	7.47	4.71
Stoneville 7A	1406	1269	90	38.2	11.7	6.12	1.15	.53	18.58	6.64	5.01
Coker 5110	1397	1260	90	38.6	12.1	6.62	1.24	.60	18.47	7.91	4.62
DES 2134-13	1313	1224	93	37.6	11.4	5.55	1.21	.59	18.81	7.51	4.35
Delcott 277	1259	1166	93	37.8	13.3	6.60	1.21	.57	19.00	8.18	4.51
C.V.		6.4									
LSD .05		96									
LSD .01		115									

Planted: May 10, 1973
Harvested: October 22 and November 14, 1973
Soil: Dundee silty loam

Table 3. Results of 1973 Cotton Variety Test - Stoneville, Mississippi*

	LINT PER ACRE					Boll	FIBER PROPERTIES				
		First	% first	Lint	Seed	size	Length		Strength	Elonga-	Micro-
	Total	pick	pick	%	index	grams	2.5%	50%	g tex	tion	naire
	(lb)	(lb)									
Deltapine 5916-65	901	814	90	38.9	11.0	5.42	1.20	.61	20.57	8.63	5.28
DES 21326-04	869	786	90	37.0	10.9	4.70	1.21	.55	20.82	6.91	4.57
Deltapine 652-679	868	759	87	39.6	10.9	5.05	1.20	.58	21.05	6.82	4.72
Stoneville 213	867	766	88	38.2	12.1	5.35	1.19	.59	20.47	7.20	4.58
DES 2134-13	846	748	88	37.8	11.1	4.87	1.21	.57	20.83	6.93	4.38
Deltapine 25	830	737	89	40.0	10.9	5.59	1.16	.56	20.68	6.80	5.15
Stoneville 7A	824	730	88	38.8	11.2	4.97	1.17	.55	18.12	5.96	5.00
Deltapine 45A	820	712	87	37.8	12.0	5.45	1.16	.60	20.11	7.80	4.89
DES 89-11-10	817	714	87	38.1	12.0	4.81	1.25	.59	20.46	6.59	4.60
Deltapine 16	804	739	92	37.4	11.5	5.36	1.19	.58	20.69	9.00	5.03
Coker 5110	795	685	86	36.6	12.9	6.30	1.25	.61	20.92	6.98	4.63
Coker 312	787	720	91	38.8	11.9	4.92	1.24	.60	21.20	6.44	4.76
Stoneville 603	763	691	91	35.9	12.5	5.00	1.16	.56	20.16	7.20	4.72
Delcott 277	762	699	92	36.6	13.9	5.57	1.28	.63	20.76	9.08	4.40
Coker 310	758	690	91	38.7	12.1	5.24	1.26	.59	21.74	6.73	4.86
C.V.	13.9	10.3									
LSD .05	131	87									
LSD .01	157	104									

Planted: May 1, 1973
Harvested: September 27 and October 18, 1973
***Soil: Sharkey clay**

Table 4. Results of 1973 Cotton Variety Test - Yazoo City, Mississippi

	LINT			Boll	FIBER PROPERTIES				
	PER ACRE	Lint	Seed	size	Length		Strength	Elonga-	Micro-
	Total	%	index	grams	2.5%	50%	g/tex	tion	naire
	(lb)								
Stoneville 213	984	41.9	10.0	5.01	1.07	.52	18.47	6.87	5.59
DES 2134-13	936	40.1	10.4	4.76	1.11	.54	19.62	6.49	5.11
DES 21326-04	932	39.7	10.1	4.98	1.13	.53	19.58	6.29	5.43
Stoneville 7A	913	41.8	10.5	5.12	1.12	.53	18.57	5.89	5.54
DES 89-11-10	896	41.6	10.7	4.77	1.15	.55	19.41	6.25	5.16
Deltapine 25	872	43.0	10.1	4.84	1.09	.53	19.15	7.04	5.51
Deltapine 652-679	866	43.8	9.5	4.70	1.10	.54	19.02	6.75	5.26
Stoneville 603	865	39.1	11.3	4.88	1.11	.54	19.49	7.55	4.88
Deltapine 16	842	40.4	10.7	5.23	1.12	.55	20.10	8.78	4.73
Deltapine 5916-65	836	41.8	10.3	5.17	1.11	.56	20.18	8.23	5.74
Deltapine 45A	833	40.6	11.1	5.02	1.05	.54	19.30	7.85	5.37
Coker 5110	827	39.3	11.5	5.64	1.14	.54	19.28	6.84	4.89
Coker 312	827	41.2	11.3	4.95	1.17	.55	19.45	6.26	4.83
Delcott 277	768	39.8	12.9	5.38	1.12	.55	19.94	8.03	4.74
Coker 310	756	40.8	11.5	5.00	1.18	.57	20.66	6.55	5.40
C.V.	11.8								
LSD .05	117								
LSD .01	139								

Planted: April 30, 1973
Harvested: October 3, 1973
Soil: Sandy loam

Table 5. Results of 1973 Cotton Variety Test - Tunica, Mississippi

	LINT PER ACRE			Boll	FIBER PROPERTIES				
	Total	Lint %	Seed index	size grams	Length 2.5%	50%	Strength g/tex	Elonga-tion	Micro-naire
	(lb)								
DES 21326-04	932	37.2	11.8	6.04	1.21	.56	19.72	6.15	4.79
Stoneville 7A	894	38.5	12.2	6.13	1.17	.54	18.44	5.56	5.30
Stoneville 603	886	36.8	13.4	6.42	1.15	.54	19.59	7.24	4.90
Stoneville 213	885	38.2	12.2	6.21	1.15	.55	17.76	6.62	5.30
Delcott 277	873	37.6	13.8	6.97	1.24	.61	19.72	8.60	4.26
Deltapine 5916-65	870	39.1	11.7	6.27	1.19	.57	19.01	8.59	5.31
DES 2134-13	858	37.6	11.9	5.63	1.23	.60	19.13	6.42	4.72
Deltapine 652-679	834	40.2	11.4	6.37	1.17	.55	17.70	6.84	4.80
Deltapine 45A	806	38.7	13.3	6.27	1.15	.56	19.22	6.99	5.08
Coker 312	799	39.6	12.5	6.30	1.25	.58	19.17	6.14	4.52
Deltapine 16	781	37.4	12.5	6.27	1.22	.58	18.89	8.35	4.85
Coker 310	754	40.4	11.0	5.50	1.22	.56	18.69	6.56	4.69
Deltapine 25	747	39.4	12.0	6.01	1.21	.58	18.79	6.76	5.08
DES 89-11-10	715	38.2	12.9	6.07	1.25	.60	19.02	6.01	4.82
Coker 5110	694	36.6	13.0	6.93	1.25	.59	17.87	7.10	4.59
Acala 1517-70	586	36.1	14.1	6.57	1.21	.59	23.81	5.15	4.25
Lockett 4789A	547	35.7	14.2	7.03	1.15	.57	18.09	6.91	4.64
C.V.	10.7								
LSD .05	97								
LSD .01	128								

Planted: May 14, 1973
Harvested: October 30, 1973
Soil: Sandy loam

Table 6. Average Performance of 15 Cotton Varieties at Five Locations in 1973

	LINT PER ACRE	Lint	Seed	Boll	FIBER PROPERTIES				
				size	Length		Strength	Elonga-	Micro-
	Total	%	index	grams	2.5%	50%	g/tex	tion	naire
	(lb)								
DES 21326-04	1028	37.2	10.9	5.18	1.19	.55	19.65	6.59	4.65
Stoneville 213	1026	38.6	11.5	5.59	1.14	.55	18.82	7.05	4.88
Deltapine 5916-65	1023	39.6	10.9	5.72	1.17	.58	19.80	8.59	5.30
Stoneville 7A	996	38.8	11.3	5.61	1.15	.54	18.61	5.82	5.09
Deltapine 652-679	990	40.6	10.5	5.44	1.16	.56	19.36	7.11	4.79
DES 2134-13	975	37.7	11.2	5.20	1.18	.56	19.88	6.80	4.56
Stoneville 603	974	36.7	12.2	5.51	1.14	.54	19.50	7.41	4.68
Deltapine 25	969	40.3	11.0	5.64	1.15	.56	19.58	6.97	5.10
Deltapine 16	963	38.3	11.6	5.89	1.18	57	19.79	8.74	4.83
Deltapine 45A	959	38.8	12.0	5.97	1.13	.57	19.32	7.67	4.93
Coker 312	952	39.5	11.7	5.53	1.22	.57	19.86	6.48	4.65
DES 89-11-10	945	38.6	11.9	5.31	1.21	.58	19.73	6.37	4.78
Coker 310	945	39.9	11.4	5.42	1.23	.58	20.10	6.67	4.86
Coker 5110	909	37.3	12.3	6.36	1.22	.58	19.48	7.23	4.57
Delcott 277	908	37.5	13.4	6.25	1.21	.59	19.97	8.43	4.39

Table 7. Average Performance of 11 Cotton Varieties at Five Locations for a 2-Year Period (1971-72).

	LINT PER ACRE					FIBER PROPERTIES				
		% first pick			Boll size	Length		Strength	Elonga-	Micro-
	Total		Lint %	Seed index	grams	2.5%	50%	g/tex	tion	naire
	(lb)	(lb)								
Deltapine 5916-65	1065	88*	39.4	10.8	5.78	1.16	.57	20.21	8.52	5.16
Stoneville 213	1046	89	38.5	11.3	5.65	1.13	.55	19.05	6.95	4.87
Stoneville 7A	1033	87	38.9	11.0	5.53	1.15	.54	18.51	5.98	4.97
Deltapine 652-679	1032	87	40.7	10.3	5.42	1.14	.55	19.21	7.00	4.70
Deltapine 25	1031	85	40.5	10.9	5.61	1.14	.56	19.70	6.82	5.03
Deltapine 16	1008	88	38.6	11.3	5.93	1.17	.56	19.84	8.47	4.79
Coker 310	996	89	39.8	11.4	5.61	1.21	.57	19.99	6.68	4.77
Stoneville 603	983	90	36.9	11.7	5.49	1.13	.53	19.57	7.24	4.52
Deltapine 45A	980	88	38.8	11.6	5.79	1.12	.56	19.63	7.70	4.89
Coker 5110	964	87	37.7	11.9	6.32	1.20	.57	19.68	7.10	4.48
Delcott 277	943	91	37.5	13.1	6.27	1.20	.59	20.73	8.42	4.22

*Percent first pick is average of six environments.

Table 8. Average performance of eight cotton varieties at 5 locations for a 4-Year period (1970-73).

	LINT PER ACRE			*Boll*	*FIBER PROPERTIES*				
					Length		*Strength*	*Elonga-*	*Micro-*
	Total	*Lint* *%*	*Seed* *index*	*size* *grams*	*2.5%*	*50%*	*g/tex*	*tion*	*naire*
	(lb)								
Deltapine 25	1020 a	40.4 a*	10.9 e	5.50 d	1.15 c	.56 c	19.42 b	7.10 d	4.93 a
Stoneville 213	1000 a	38.3 d	11.4 cd	5.74 c	1.14 c	.56 c	18.54 c	7.22 cd	4.92 a
Deltapine 16	992 a	38.4 cd	11.4 cd	5.99 b	1.17 b	.57 b	19.15 b	8.60 a	4.73 b
Stoneville 7A	989 ab	38.9 bc	11.2 de	5.55 cd	1.15 c	.55 d	18.17 c	6.22 e	4.94 a
Deltapine 45A	986 ab	38.8 bcd	11.4 cd	5.68 cd	1.12 d	.56 c	19.13 b	7.74 b	4.79 ab
Coker 310	985 ab	39.3 b	11.6 c	5.68 cd	1.22 a	.57 b	19.29 b	7.04 d	4.71 b
Stoneville 603	942 bc	36.4 f	12.1 b	5.64 cd	1.15 c	.55 d	19.26 b	7.47 bc	4.53 c
Delcott 277	922 c	37.2 e	13.1 a	6.40 a	1.21 a	.59 a	20.24 a	8.70 a	4.15 d

***Means followed by the same letter are not significantly different at 5% level of probability.**

Table 9. Average Lint Yield of Eight Cotton Varieties at Five Locations for a 4-Year Period (1970-73).

Variety Test Locations	*Year*	*Stoneville 213*	*Deltapine 16*	*Deltapine 45A*	*Stoneville 7A*	*Stoneville 603*	*Delcott 277*	*Coker 310*	*Deltapine 25*
Stoneville (sand)	1970	1305	1308	1285	1304	1127	1122	1187	1411
Stoneville (sand)	1971	1132	1183	1178	1079	1102	1198	1133	1186
Stoneville (sand)	1972	965	973	916	951	941	899	959	1000
Stoneville (sand)	1973	966	948	921	943	919	878	947	980
Average	--	1092	1103	1075	1069	1022	1024	1056	1144
Stoneville (clay)	1970	311	427	466	346	391	311	403	438
Stoneville (clay)	1971	585	557	551	627	490	611	581	621
Stoneville (clay)	1972	938	942	898	942	754	830	966	975
Stoneville (clay)	1973	867	804	820	824	763	762	758	830
Average	--	675	682	684	685	599	628	677	716
Yazoo City	1970	1004	997	1011	932	854	780	955	984
Yazoo City	1971	660	654	711	625	620	576	795	752
Yazoo City	1972	1093	1051	930	1086	1057	968	1009	1114
Yazoo City	1973	984	842	833	913	865	768	756	872
Average	--	935	886	871	889	849	773	879	930
Tunica	1970	789	902	843	778	861	764	824	835
Tunica	1971	932	960	1014	970	890	1022	975	998
Tunica	1972	854	865	815	859	783	731	839	860
Tunica	1973	885	781	806	894	886	873	754	747
Average	--	865	877	869	875	855	847	848	860
Sumner	1970	1356	1357	1339	1329	1259	1142	1345	1359
Sumner	1971	1467	1404	1515	1462	1409	1480	1533	1519
Sumner	1972	1483	1441	1446	1515	1423	1469	1464	1515
Sumner	1973	1430	1442	1417	1406	1438	1259	1511	1415
Average	--	1434	1411	1429	1428	1382	1337	1463	1452
4-Yr. Avg. 5 Locations	--	1000	992	986	989	942	922	985	[illegible]

Table 10. Average Lint Yield of Four Cotton Varieties at Five Locations

Variety and Test Location	*1965*	*1966*	*1967*	*1968*	*1969*	*1970*	*1971*	*1972*	*1973*	*9-Yr. Average*
Stoneville (sand)										
Deltapine 16	1200	1014	1040	1198	851	1308	1183	973	948	1079
Stoneville 213	1231	1000	984	1154	893	1305	1132	965	966	1070
Deltapine 45A	1176	989	1004	1130	891	1285	1178	916	921	1054
Stoneville 7A	1281	924	939	1128	770	1304	1079	951	943	1035
Yazoo City										9-Yr. Average
Deltapine 16	920	790	1114	1341	362	997	654	1051	842	897
Stoneville 213	1024	793	1117	1432	440	1004	660	1093	984	950
Deltapine 45A	903	769	1079	1259	377	1011	711	930	833	875
Stoneville 7A	967	779	1094	1416	480	932	625	1086	913	921
Tunica										8-Yr. Average
Deltapine 16	926	1060	1010	--	663	902	960	865	781	896
Stoneville 213	892	1009	969	--	720	789	932	854	885	881
Deltapine 45A	934	992	995	--	650	843	1014	815	806	881
Stoneville 7A	847	1031	914	--	719	778	970	859	894	876
Sumner										7-Yr. Average
Deltapine 16	--	--	1514	1111	1151	1357	1404	1441	1442	1346
Stoneville 213	--	--	1415	1135	1140	1356	1467	1483	1430	1347
Deltapine 45A	--	--	1479	1151	1167	1339	1515	1446	1417	1359
Stoneville 7A	--	--	1391	1068	1070	1329	1462	1515	1406	1320
Stoneville (clay)										6-Yr. Average
Deltapine 16	--	--	--	1056	757	427	557	942	804	757
Stoneville 213	--	--	--	1034	742	311	585	938	867	746
Deltapine 45A	--	--	--	1081	758	466	551	898	820	762
Stoneville 7A	--	--	--	986	596	346	627	942	824	720

Hill Section

Cotton variety tests were planted at six locations in the Hill Section in 1973. Wet spring weather resulted in late planting at all locations, and failure of the test at one location. In addition, 2,4-D damage caused the test at Pontotoc to be abandoned. A list of the four locations from which data were obtained, and the cultural practices at each of these, are given in Table 1.

The same sixteen varieties were included in the tests at all locations. Of these, Dixie King 375 was tested for the first time. Yield and yield related data collected at all locations included lint per acre, percent lint, and number of bolls per pound of seed cotton. At one location, earliness of maturity was estimated by determining percentage of the total crop picked at the first harvest.

Staple length and micronaire index were determined for each variety at each location by the U.S.D.A. Cotton Classing Office, Jackson, Mississippi. Fiber strength in thousand pounds per square inch at zero Pressley, 2.5% span length, and length uniformity ratio were obtained on lint samples from three locations. These lint characteristics are defined as follows: Fiber strength in tensile strength of the fiber with no space between clamps; 2.5% span length is the length in inches of the longest 2.5% of the fibers in the sample; and uniformity is the ratio of 50% span length to 2.5% span length multiplied by 100 to convert to percentage.

For the Hill Section location
average yield obtained in 1973
given in Table 2. The three-year a
erage yield, a more reliable indica
tion of performance, is given in T
ble 3. Performance of the varieties
individual locations in 1973 and tw
or three-year averages are given i
Tables 4-13.

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the indicated varieties:

COKER PEDIGREED SEE
COMPANY, HARTSVILLE, SOUT
CAROLINA: Coker 310, Coker 417
Coker 5110.

DELTA AND PINE LAN
COMPANY, SCOTT, MISSISSIPP
Deltapine 16, Deltapine 25, Delta
pine 45A, Deltapine 652.

DELTA BRANCH EXPERIMEN
STATION, STONEVILLE, MISSIS
SIPPI: DES-67-213.

DELTA CENTER, PORTAGEVILLE, MISSOURI: Delcott 277.

PENNINGTON GRAIN AN
SEED, INC., MADISON, GEORGIA
Hybee 100A, Hybee 200A.

STONEVILLE PEDIGREED SEED COMPANY, STONEVILLE, MISSISSIPPI: Dixie King 375, Stoneville 7A, Stoneville 213, Stoneville 603.

WEST TENNESSEE EXPERIMENT STATION, JACKSON, TENNESSEE: Hancock.

able 1. Cultural practices used at cotton variety test locations in 1973.

ocation	*Soil Type*	*N-P_2O_5-K_2O fertilizer*	*Plot size length*	*Plot size width*	*Planting date*
		lbs./A.	*ft.*	*no. rows*	*mo./day*
rooksville	Houston clay	94-65-65	100	1	5/24
olly Springs	Grenada silt loam	120-60-60	70	1	5/18
aymond	Grenada silt loam	100-120-120	30	1	5/24
erona	Catalpa silty clay loam	120-60-60	30	1	5/15

Table 2. Lint yield, in pounds per acre, of 16 cotton varieties tested at four locations in the Hill Section in 1973.

Variety	*Raymond*	*Verona*	*Brooks-ville*	*Holly Springs*	*Average*
Stoneville 213	932	678	592	608	703
Hybee 100A	930	621	634	521	677
Hybee 200A	894	690	588	537	677
Deltapine 652	850	696	575	544	666
Hancock	833	610	486	649	645
Deltapine 25	864	614	642	486	652
Deltapine 16	864	569	645	497	644
Stoneville 7A	747	610	588	630	644
DES-67-213	788	523	610	607	632
Coker 310	919	530	549	499	624
Coker 5110	933	500	514	491	610
Stoneville 603	708	591	534	607	610
Coker 417	831	520	643	426	605
Dixie King 375	814	504	494	571	596
Delcott 277	670	569	631	499	592
Deltapine 45A	864	527	480	477	587
Average	840	585	574	541	635

Table 3. Two or three-year average yield of 11 cotton varieties tested at s locations in the Hill Section.

Variety	*Raymond*[1]	*Miss.*[2] *State*	*Holly-*[4] *Springs*	*Verona*[3]	*Brooks-*[4] *ville*	*Pontotoc*[2]	*A*
Hybee 200A	929	794	799	784	632	479	7
Hybee 100A	914	748	674	730	641	487	6
Stoneville 213	951	733	670	731	603	481	6
DES-67-213	876	753	747	644	616	430	6
Hancock	931	675	773	645	563	425	6
Coker 310	993	723	581	625	575	468	6
Deltapine 16	878	786	610	607	609	437	6
Stoneville 7A	871	679	741	639	560	407	6
Coker 417	860	754	565	608	631	422	6
Stoneville 603	797	624	723	646	526	420	62
Deltapine 45A	884	733	595	632	530	351	62
Average	899	727	680	663	590	437	6

[1] **Two year average, 1972 and 1973.**
[2] **Two year average, 1971 and 1972.**
[3] **Two year average, 1971 and 1973.**
[4] **Three year average, 1971,1972, and 1973.**

Table 4. Cotton variety performance at the Black Belt Branch Experiment Station, Brooksville, in 1973.

Variety	*Lint/ acre*	*Lint %*	*Bolls/ lb.*	*Fiber Properties* *1st picking*	*Staple length*	*Mik*
	lbs.	%	no.	%	1/32 in.	Inde
Deltapine 16	645	38	89	87	36	4.
Coker 417	643	38	75	85	37	4.
Deltapine 25	642	39	86	83	35	4.
Hybee 100A	634	38	82	86	36	4.
Delcott 277	631	38	79	91	36	3.
DES-67-213	610	37	84	86	35	4.
Stoneville 213	592	38	80	87	35	4.8
Hybee 200A	588	37	80	83	35	4.2
Stoneville 7A	588	37	80	91	36	4.8
Deltapine 652	575	39	95	90	36	4.0
Coker 310	549	36	79	89	36	3.9
Stoneville 603	534	36	88	89	36	4.2
Coker 5110	514	38	75	88	37	4.1
Dixie King 375	494	37	78	90	36	4.0
Hancock	486	39	77	95	35	4.2
Deltapine 45A	480	38	92	88	36	4.4
Average	574	38	82	88	36	4.2
C.V.	12.3%					
LSD .05	81					
LSD .01	108					

able 5. Three-year averages, Black Belt Branch Experiment tation, Brooksville, in 1971-1973.

				Fiber Properties	
ariety	*Lint/ acre*	*Lint %*	*Bolls/ lb.*	*Staple length*	*Mike*
	lbs.	*%*	*no.*	*1/32 in.*	*Index*
Hybee 100A	641	37	78	35	4.6
Hybee 200A	632	38	76	35	4.8
Coker 417	631	37	73	36	4.6
DES-67-213	616	38	79	35	4.5
Deltapine 16	609	37	78	36	4.6
Stoneville 213	603	38	77	35	5.0
Coker 310	575	38	76	36	4.5
Hancock	563	38	68	35	4.5
Stoneville 7A	560	38	75	35	5.2
Deltapine 45A	530	37	81	35	4.8
Stoneville 603	526	36	78	36	4.4
Average	590	37	76	35	4.7

Table 6. Cotton variety performance at the Northeast Mississippi Branch Experiment Station, Verona, in 1973.

				Fiber Properties	
Variety	*Lint/ acre*	*Lint %*	*Bolls/ lb.*	*Staple length*	*Mike*
	lbs.	*%*	*no.*	*1/32 in.*	*Index*
Deltapine 652	696	39	83	35	4.8
Hybee 200A	690	37	77	35	4.7
Stoneville 213	678	38	81	35	4.8
Hybee 100A	621	37	81	35	4.6
Deltapine 25	614	40	80	36	5.0
Hancock	610	39	74	35	4.6
Stoneville 7A	610	38	83	36	4.7
Stoneville 603	591	36	87	35	4.5
Deltapine 16	569	37	82	35	4.8
Delcott 277	569	37	70	36	4.6
Coker 310	530	38	85	37	4.4
Deltapine 45A	527	38	83	35	4.7
DES-67-213	523	37	82	34	4.8
Coker 417	520	37	78	35	4.4
Dixie King 375	504	37	72	35	4.5
Coker 5110	500	37	72	36	4.5
Average	585	38	79	35	4.7
C.V.	15.6%				
LSD .05	105				
LSD .01	139				

Table 7. Two-year averages, Northeast Mississippi Branch Experime Station, Verona, 1971 and 1973.

Variety	Lint/ acre	Lint %	Bolls/ lb.	Fiber Properties Staple length	Mi
	lbs.	%	no.	1/32 in.	Inde
Hybee 200A	784	38	75	36	4
Stoneville 213	731	38	78	35	5
Hybee 100A	730	37	76	36	4
Stoneville 603	646	36	82	35	4
Hancock	645	39	70	35	4
DES-67-213	644	37	78	35	4
Stoneville 7A	639	38	80	36	4
Deltapine 45A	632	38	80	35	4.
Coker 310	625	38	84	37	4.
Coker 417	708	36	75	36	4.
Deltapine 16	607	36	78	35	4.
Average	663	37	78	36	4.

Table 8. Cotton variety performance at the North Mississippi Branch Experimen Station, Holly Springs, in 1973.

Variety	Lint/ acre	Lint %	Bolls/ lb.	Fiber properties Staple length	Mike	Strength	2.5% span	Ul
	lbs.	%	no.	1/32 in.	index	M.P.S.I.	in.	%
Hancock	649	42	76	34	4.9	95	1.03	48
Stoneville 7A	630	41	85	35	5.3	95	1.06	46
Stoneville 213	608	42	86	34	5.5	86	1.05	47
DES-67-213	607	41	88	34	5.0	85	1.04	47
Stoneville 603	607	39	86	34	5.0	90	1.08	47
Dixie King 375	571	40	78	34	4.8	91	1.00	48
Deltapine 652	544	43	89	35	5.1	90	1.06	46
Hybee 200A	537	41	80	34	5.1	84	1.05	47
Hybee 100A	521	40	82	35	5.1	87	1.07	48
Delcot 277	499	40	76	35	4.5	87	1.08	48
Coker 310	499	43	92	35	5.1	89	1.10	46
Deltapine 16	497	40	88	35	5.2	82	1.09	48
Coker 5110	491	41	74	36	5.0	95	1.10	47
Deltapine 25	486	42	87	34	5.3	89	1.07	49
Deltapine 45A	477	40	83	34	5.3	90	1.03	48
Coker 417	426	40	82	35	4.8	95	1.10	47
Average	541	41	83	35	5.1	89	1.06	47
C.V.	15.3%							
LSD .05	82							
LSD .01	108							

able 9. Three-year averages, North Mississippi Branch Experiment Station, olly Springs, 1971-1973.

				Fiber properties				
ariety	*Lint/ acre*	*Lint %*	*Bolls/ lb.*	*Staple length*	*Mike*	*Strength*	*2.5% span*	*UR*
	lbs.	*%*	*no.*	*1/32 in.*	*Index*	*M.P.S.I.*	*in.*	*%*
Hybee 200A	799	41	82	35	5.0	83	1.08	47
DES-67-213	747	41	85	34	4.9	75	1.06	47
Stoneville 7A	741	41	84	35	5.2	70	1.08	46
Hancock	724	42	72	34	4.8	90	1.05	47
Stoneville 603	723	39	84	34	4.9	87	1.09	47
Hybee 100A	674	40	79	35	4.9	86	1.11	47
Stoneville 213	670	41	83	34	5.4	81	1.07	47
Deltapine 16	610	40	83	35	4.9	82	1.10	49
Deltapine 45A	595	40	85	34	5.1	84	1.06	49
Coker 310	581	43	86	35	5.0	88	1.15	47
Coker 417	565	40	82	35	4.6	91	1.12	48
Average	675	41	82	35	5.0	85	1.09	47

Table 10. Cotton variety performance at the Brown Loam Branch Experiment Station, Raymond, in 1973.

				Fiber properties				
Variety	*Lint/ acre*	*Lint %*	*Bolls/ lb.*	*Staple length*	*Mike*	*Strength*	*2.5% span*	*UR*
	lbs.	*%*	*no.*	*1/32 in.*	*Index*	*M.P.S.I.*	*in.*	*%*
Coker 5110	933	40	76	35	4.5	81	1.12	47
Stoneville 213	932	41	76	34	5.0	82	1.10	47
Hybee 100A	930	41	77	35	4.7	80	1.13	47
Coker 310	919	43	84	36	4.7	85	1.15	47
Hybee 200A	894	41	69	35	4.8	82	1.11	48
Deltapine 16	864	41	74	35	4.8	78	1.11	45
Deltapine 25	864	42	79	35	5.1	84	1.08	48
Deltapine 45A	864	41	88	35	4.9	78	1.10	46
Deltapine 652	850	44	83	35	4.8	83	1.11	47
Hancock	833	42	76	34	4.6	86	1.03	47
Coker 417	831	40	79	35	4.3	88	1.13	47
Dixie King 375	814	40	74	35	4.5	88	1.08	46
DES-67-213	788	39	86	35	4.5	76	1.07	46
Stoneville 7A	747	40	80	35	5.0	91	1.10	46
Stoneville 603	708	39	84	35	4.5	86	1.09	48
Delcott 277	670	41	73	35	4.3	83	1.11	45
Average	840	41	79	35	4.7	83	1.10	47
C.V.	13.3%							
LSD .05	128							
LSD .01	170							

Table 11. Two-year averages Brown Loam Branch Experiment Station, Raymo
1972 and 1973.

				Fiber properties			
Variety	Lint/ acre	Lint %	Bolls/ lb.	Staple length	Mike	Strength	2.5% span
	lbs.	%	no.	1/32 in.	Index	M.P.S.I.	in.
Coker 310	993	42	77	35	4.7	84	1.14
Coker 5110	961	41	76	36	4.6	84	1.13
Stoneville 213	951	41	78	34	5.0	86	1.09
Deltapine 652	935	43	82	35	4.8	84	1.10
Hancock	931	41	74	34	4.7	90	1.03
Hybee 200A	929	40	76	35	4.8	86	1.11
Hybee 100A	914	40	78	35	4.7	84	1.13
Deltapine 45A	884	41	84	35	5.0	80	1.08
Deltapine 16	878	41	73	35	4.9	82	1.10
DES-67-213	876	40	90	35	4.5	81	1.07
Stoneville 7A	871	41	88	35	5.0	91	1.09
Coker 417	860	40	78	35	4.4	91	1.11
Delcott 277	843	42	75	36	4.3	84	1.12
Stoneville 603	797	39	86	35	4.5	88	1.08
Average	902	41	80	35	4.8	85	1.10

Table 12. Two-year averages, Pontotoc Branch Experiment Statio
Pontotoc, 1971 and 1972.

				Fiber Properties	
Variety	Lint/ acre	Lint %	Bolls/ lb.	Staple length	Mik
	%	%	no.	1/32 in.	Inde
Hybee 100A	487	40	83	35	4.
Stoneville 213	481	38	84	34	5.
Hybee 200A	479	39	86	34	5.
Coker 310	468	41	82	35	4.
Deltapine 16	437	38	84	35	4.
DES-67-213	430	38	87	34	4.
Hancock	425	39	75	34	4.
Coker 417	422	38	82	35	4.
Stoneville 603	420	36	83	34	4.
Deltapine 6225	415	40	89	35	4.
Stoneville 7A	407	39	87	34	4.
Deltapine 45A	351	39	87	35	4.4
Averages	435	39	84	35	4.7

ble 13. Two-year averages, Central Station, Mississippi State, 1971 and 1972.

ariety	*Lint/ acre*	*Lint %*	*Bolls/ lb.*
	lbs.	%	no.
ybee 200A	794	40	82
eltapine 16	786	40	77
oker 417	754	39	83
ES-67-213	753	40	81
lybee 100A	748	39	83
eltapine 45A	733	40	86
toneville 213	733	40	86
oker 310	723	39	80
oker 201	720	41	85
toneville 7A	679	40	84
ancock	675	40	74
eltapine 6225	669	41	84
toneville 603	624	38	84
Averages	722	40	82

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13 May 1974

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By W. I. Spurgeon
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LIMITED SEEDBED PREPARATION FOR COTTON

Bulletin 813

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Limited Seedbed Preparation for Cotton

LIMITED SEEDBED PREPARATION FOR COTTON

W. I. Spurgeon, J. M. Anderson, G. R. Tupper and F. T. Cooke[1]

Field operations in seedbed preparation for cotton planting may vary in number from one to twenty. Cotton producers in the Yazoo-Mississippi Delta have for many years excessively tilled the sandy loam, silt loam and silty clay loam soils prior to planting. Excessive tillage is expensive and is probably responsible for the poor physical condition of our cotton soils. Soils of this region are low in organic matter, eroded, and severely compacted. Most of the cotton soils, especially the silt loams, must be subsoiled annually to produce highest yields. Because of these conditions, seedbed preparation for cotton should be limited to field operations necessary to eliminate weeds that interfere with planting and production.

Limited seedbed preparation for cotton in the Delta region is not new. Tests conducted on both loam and clay soils at the Delta Branch Experiment Station (2) from 1926-1932 showed no difference between various methods of seedbed preparation. Several studies, involving limited seedbed techniques for cotton, have been made in this region since 1932 (2, 4, 5, 6, 7). Limited seedbed preparation in these studies, as compared with conventional methods, did not reduce but in some cases slightly increased cotton yields.

This study included one phase of an overall effort to reduce cost and increase returns from cotton production and continued the seedbed studies (5) conducted from 1967-1969. The specific objective was to find a more economical and effective method of seedbed preparation for cotton.

Materials and Methods

An experiment was initiated in 1970 on a Bosket sandy loam soil. Stalks were cut and the field was subsoiled at a 45 or 90° angle to row direction in the fall or spring each year. All subsequent seedbed operations occurred in the spring from February 20 to planting. A completely randomized block experimental design with 5 treatments and 6 replications was used and plots were maintained in the same location each year. The plot size of each treatment was six rows 550′ long. Three of the five treatments remained constant over the four-year period while two varied from year to year. The seedbed treatments for each year are shown in Table 1 through 4. Since stalk cutting, subsoiling and bed conditioning were the same for all treatments, they are not listed in the description of treatments.

Nitrogen, as a 32% urea-ammonium nitrate solution, was applied prior to planting at a rate of 80 lbs. N per acre. The variety Stoneville 213 was used each year and planted from April 23 to May 4.

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Diuron was applied preemergence each year on a 20-inch band at a rate of 0.7 lb/A, except in 1970 when the width of the diuron band varied for different seedbed treatments. Cultural practices common to this area were used each year for postemergence weed and insect control. All plots were hand hoed twice each year and hoe time was recorded to give some indication of the difference in weed populations between seedbed treatments. Equipment costs associated with all field operations were calculated on the basis of data reported in an earlier publication (1) for the economic analyses included in this report. The cotton was harvested twice each year with a mechanical picker, weights recorded, and a 15-20 pound composite sample of replications was obtained from each treatment for determination of lint percent, staple length and grades.

Results and Discussion

In 1970 there were no significant differences between seedbed treatments as reflected by yield, hoe labor, and returns (Table 1). Although not statistically significant, seedbed treatments of one and two hippings produced about 4% more cotton than the conventional treatment. The per acre value, compared to conventional seedbed preparation, was $15.25 and $11.57 for the seedbed treatments of one and two hippings, respectively.

In 1971 all limited seedbed treatments (treatments 2, 3, and 4), with the exception of treatment 5 where paraquat was used, produced significantly more cotton at first and total harvest than was obtained from the conventional seedbed (Table 2). Seedbed treatments of one and two hippings produced 11% more lint cotton than the conventional seedbed treatment.

There was no significant difference in hoe labor between treatments except where paraquat was used. Most of the hoe labor for the paraquat treatment was required for removal of late winter and early spring weeds that paraquat failed to kill. The rate of 0.25 lb/A of paraquat mixed with 0.7 lb/A of diuron and applied on a 20-inch band centered on the drill gave very poor control of winter weeds in 1971. Paraquat at 0.25 lb/A broadcast is excellent for killing small winter weeds. These winter weeds, which include several species, may attain considerable vegetative growth by the time cotton is planted. Under these conditions, paraquat at 0.25 lb/A broadcast failed to effectively control the winter weeds. The effectiveness of paraquat was apparently reduced by insufficient spray droplet coverage where a dense vegetative growth of weeds existed.

The value of lint, seed, total returns, returns above specified costs, and net returns were significantly increased by seedbed treatments of one and two hippings (treatments 2 and 3, Table 2) as compared with the conventional seedbed. The per acre value compared to conventional seedbed preparation was $34.12 and $34.52 for the hip once and hip twice seedbed treatments, respectively.

The 1972 treatments and results are shown in Table 3. Treatments 4 and 5 were modified in 1972. Studies in the Delta and other areas of the country had indicated some yield increase from planting cotton in twin drills or rows. Therefore, treatment 4 was modified to include this practice with seedbed preparation identical to treatment 2 (hip twice, condition beds and plant).

Since the method of paraquat application was ineffective for treatment 5 in 1971, the technique of application was changed in 1972. The price of paraquat prohibits use of more than 0.25 lb/A. At $32.00 per 2 lbs, the use of 0.25 lb/A costs $4.00 compared to the cost for two hippings with a 6-row hipper at less than $2.00 per acre. In 1972 0.125 lb/A of paraquat was broadcast early (2-29-72) when the winter weeds were small and another 0.125 lb/A was broadcast at planting (4-27-72). This treatment also failed to control the winter weeds. Due to excessive winter weeds and poor cotton stands the plots were hipped twice and replanted May 15.

Yields of the twin row cotton (treatment 4) were significantly greater than those of the conventional and paraquat seedbed treatments in 1972. There were no significant differences in yields between any of the other seedbed treatments. However, the hip once treatment produced 3.6 and the hip twice treatment 7.7% more cotton than the conventional seedbed method.

The hoe labor required was significantly more for the twin row and paraquat treatments as compared with the conventional seedbed. The twin row cotton was physically harder to hoe and may partially account for the extra hoe labor required. The effect of seedbed treatment on lint and seed value, total returns, returns above specified costs and net returns (Table 3) was similar to the effect on yield. The per acre value of one hipping, two hippings and twin row treatments as compared to the conventional seedbed, was $18.45, $23.84 and $46.04, respectively.

The 1973 treatments and results are shown in Table 4. In 1973 glyphosate was used on treatment 5 in an attempt to eradicate winter weeds prior to planting. Glyphosate is a new herbicide, not yet labelled, produced by the Monsanto Company. A broadcast application of 1.0 lb/A of glyphosate with surfactant was used approximately one month prior to planting. Activity of this herbicide was slow and no effect was visible on the winter weeds until 10 days after application. However, after 20 days all winter weeds were completely dead and the plots were free of weeds when planted (5-4-73). The advantage of glyphosate for this purpose will be dependent upon the market price.

There were no significant differences in yields and returns between any of the seedbed treatments in 1973. The hoe time required was significantly greater for all limited seedbed treatments as compared to the conventional treatment. Visual observation of more abundant vegetation and the extra hoe time required indicated that winter weeds gradually increased with the use of limited seedbed preparation. However, this may be more beneficial than harmful since they serve as a form of winter cover crop and help reduce erosion of the cotton soils of this region.

The four-year average yields, hoe labor and returns for the three treatments (1, 2, and 3) are shown in Table 5. The lint cotton yields at first and total harvest were significantly increased by the one and two seedbed treatments.

The four-year average hoe time was significantly greater for the two limited seedbed treatments, but the extra time required (0.25 hr/acre) is of minor economic importance.

The value of lint, total returns, returns above specified costs and net returns were significantly increased by the limited seedbed treatments. The per acre value, compared with conventional seedbed, of the one and two hipping seedbed treatments was $20.59 and $18.09, respectively. The 5 to 6% yield increase accounts for most of the extra returns from the reduced seedbed practices. Compared with the conventional seedbed, the one and two hipping seedbed treatments reduced operational costs by approximately $6.00 and $5.00 per acre, respectively.

Seedbed preparation methods had no measured effect on lint percent, staple length and grades of cotton.

One hipping operation, when properly timed (early while winter weeds are small), adequately controls winter weeds but it does leave quite a number of weeds on the shoulder of the beds. This has not been detrimental to yield but it is unsightly and may, therefore, be difficult for a farmer to accept. It is also conceivable that, under certain climatic conditions, one hipping operation would not adequatley control these weeds. Two hipping operations properly timed, one early while winter weeds are small and another approximately two weeks prior to planting, gave good control in these studies and should effectively control winter weeds under most climatic conditions. Two hipping operations resulted in better winter weed control and a more uniform seedbed.

There are both advantages and disadvantages for limited seedbed preparation. Some of the advantages are:

1. Reduced cost of inputs for labor and equipment.
2. Reduced fuel usage.
3. Convenience and timing of operations are easier, seedbed preparation faster and simpler.
4. Increased yields and returns per acre are probably the most important advantages. Seven years of research at the Delta Branch Experiment Station has not shown a decrease in yields or net returns.
5. Less soil erosion during winter and early spring rains, also less soil compaction due to reduced and restricted tractor and implement traffic.
6. More early cotton which usually brings a better price.
7. Fewer tractors are required for a given size of farm organized in a given manner.

Some disadvantages are:

1. If a broadcast application of a preplant herbicide is *needed* it canno be effectively incorporated into the soil in an exclusive hipping operation.
2. Should not be used on fields moderately to heavily infested with perennial weeds, such as johnsongrass, bermudagrass and redvine.
3. Should not be used on fields where verticillium wilt is a problem.
4. Less attractive than conventional seedbed.

Based on the results of seven years research, the following seedbed preparation is recommended for sandy loam, silt loam and silty clay loam cotton soils. It is not recommended for fields moderately to severely infested with perennial weeds and verticillium wilt.

1. Cut stalks.

2. Subsoil in fall at a 90° or preferably 45° angle to row direction. If weather does not permit fall subsoiling it should be done in the same manner in the spring.

3. Hip once over old beds in early spring or while winter weeds are small (February 20 - March 10).

4. Rehip and apply fertilizer about 10-14 days prior to planting.

5. Condition beds and plant using the recommended herbicide.

Acknowledgement

Appreciation is extended to Irvin Baugh, Agricultural Aide, for his excellent assistance.

Table 1. Effect of limited seedbed preparation on cotton yield, hoe time and returns in 1970.

	Pounds lint/acre					Returns in dollars per acre					
Seedbed treatment	1st pick	2nd pick	Total	% Yield increase	Hrs/acre hoe time	Lint[1]	Seed	Total	Above specified costs	Net	Above conventional
1. Conventional – disk twice, chisel twice, hip twice	1059	125	1184	—	0.71	259.70	51.72	311.42	205.87	118.67	---
2. Hip twice	1144	86	1230	3.9	0.84	269.86	53.75	323.61	223.23	130.24	11.57
3. Hip once	1123	109	1232	4.1	0.76	270.30	53.84	324.14	227.03	133.92	15.25
4. Condition old beds, plant using a 12″ band of diuron	1100	84	1184	0	0.79	259.73	51.73	311.46	212.78	121.46	2.79
5. Condition old beds, plant using a 16″ band of diuron	1043	123	1166	-1.5	0.70	255.78	50.95	306.73	208.66	117.99	- 0.68
	N.S.[2]	N.S.	N.S.		N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	

[1] Based on cotton lint value of $23.72 per hundred wt. the average price received by farmers in this area for SLM 1-1/16 inch grade in 1970.

[2] Not significant at the .05 level.

Table 2. Effect of limited seedbed preparation on cotton yield, hoe labor, and returns in 1971.

Seedbed treatment	Pounds lint/acre			% Yield increase	Hrs/acre hoe time	Returns in dollars per acre					
	1st pick	2nd pick	Total			Lint[1]	Seed	Total	Above specified costs	Net	Above conventional
1. Conventional – disk twice, chisel twice, hip twice	804bc[2]	183	987b	---	0.71a	289.53bc	49.43a	338.96bc	231.68b	146.92b	--
2. Hip twice	874ab	222	1096a	11.0	0.80a	320.32a	51.72a	372.04a	269.87a	181.44a	34.52
3. Hip once	869ab	227	1096a	11.0	0.85a	321.38a	49.89a	371.27a	269.67a	181.04a	34.12
4. Hip once with modified hipper	892a	171	1063a	7.7	0.97a	310.85ab	50.75a	361.60ab	260.14a	172.89a	25.97
5. Paraquat 0.25 lb/A combined with diuron and applied on 20" band at planting	757c	202	959b	-2.9	2.17b	281.30c	45.17b	326.47c	223.00b	139.25b	-7.67
		N.S.[3]									

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[1] Based on cotton lint value of $29.24 per hundred wt. the average price received by farmers in this area for SLM 1-1/16 inch grade in 1971.

[2] Means within columns with the same letter are not significantly different at the .05 level.

[3] Not significant at the .05 level.

Table 3. Effect of limited seedbed preparation on cotton yield, hoe labor, and returns in 1972.

Seedbed treatment	Pounds lint/acre			%Yield increase	Hrs/acre hoe time	Returns in dollars per acre					
	1st pick	2nd pick	Total			Lint^1	Seed	Total	Above specified costs	Net	Above conventional
1. Conventional – disk twice, chisel twice, hip twice	1042b^2	38	1080b	--	0.41a	286.39b	42.04b	328.42b	207.20bc	118.67bc	--
2. Hip twice	1118ab	45	1163ab	7.7	0.59ab	305.41ab	45.67a	351.08ab	233.81ab	142.51ab	23.84
3. Hip once	1069b	50	1119ab	3.6	0.59ab	300.93ab	43.99ab	344.93ab	226.90bc	137.12bc	18.45
4. Hip twice, plant twin drills 7" apart	1170a	37	1207a	11.8	0.64bc	323.58a	46.85a	370.43a	257.34a	164.71a	46.04
5. Paraquat 0.125 lbs early and 0.125 lb/A broadcast at planting	1036b	53	1089b	1.0	0.80c	292.75b	41.52b	334.27b	203.59c	114.69c	- 3.98
		N.S.^{3}									

[1] Based on cotton lint value of $26.91 per hundred wt. the average price received by farmers in this area for SLM 1-1/16 inch grade in 1972.

[2] Means within columns with the same letter are not significantly different at the .05 level.

[3] Not significant at the .05 level.

Table 4. Effect of limited seedbed preparation on cotton yield, hoe labor and returns in 1973.

	Pounds lint/acre					Returns in dollars per acre					
Seedbed treatment	1st pick	2nd pick	Total	%Yield increase	Hrs/acre hoe time	Lint[1]	Seed	Total	Above specified costs	Net	Above conventional
1. Conventional – disk twice, chisel twice, hip twice	777	252	1029	--	1.06a[2]	429.74	85.48	515.22	404.10	320.81	--
2. Hip twice	783	245	1028	0	1.61b	429.47	84.23	513.70	406.73	323.24	2.43
3. Hip once	797	253	1050	2.0	1.69b	438.52	87.26	525.77	419.23	335.37	14.56
4. Hip twice, plant twin drills 7'' apart	791	252	1043	1.4	1.90b	435.80	85.40	521.20	416.61	333.00	12.19
5. Glyphosate 1# per acre broadcast	835	245	1080	5.0	1.62b	451.05	90.15	541.20	419.86	334.32	15.51
	N.S.[3]	N.S.	N.S.			N.S.	N.S.	N.S.	N.S.	N.S.	

[1] Based on cotton lint value of $41.74 per hundred wt. the average price received by farmers in this area for SLM 1-1/16 inch grade in 1973.

[2] Means within columns with the same letter are not significantly different at the .05 level.

[3] Not significant at the .05 level.

Table 5. Effect of limited seedbed preparation on cotton yield, hoe time and returns (1970-1973, 4-year average, Bosket sandy loam soil, DBES).

	Pounds lint/acre					Returns in dollars per acre					
Seedbed treatment	1st pick	2nd pick	Total	%Yield increase	Hrs/ acre hoe time	Lint[1]	Seed	Total	Above specified costs	Net	Above convention
1. Conventional disk twice, chisel twice, hip twice	921b[2]	150	1070b	--	0.72b	316.34b	57.17	373.51b	262.21b	176.27b	--
2. Hip twice	980a	150	1130a	5.6	0.96a	331.26a	58.84	390.11a	283.41a	194.36a	18.09
3. Hip once	965a	160	1124a	5.0	0.97a	332.78a	58.75	391.53a	285.71a	196.86a	20.59
		N.S.[3]					N.S.				

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[1] Based on cotton lint value of $30.40 per hundred wt. the average price received by farmers in this area for SLM 1-1/16 inch grade over the 4-year period.

[2] Means within columns with the same letter are not significantly different at the .05 level.

[3] Not significant at the .05 level.

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f plants infested by 3rd-generation lar- ae. The in-furrow treatment with carbo- ıran at planting and the foliar applica- ıons of carbofuran against 3rd-generation ›uthwestern corn borers may have some dvantage over the 4 foliar applications of arbofuran applications, particularly since ·e have had some difficulty in the timing f the applications against the 2nd-gener- tion (light trap data or dissection of talks infested with 1st-generation orers). This difficulty occurs primarily ecause so few 1st-generation moths are ıken in blacklight traps and because in- ›station of corn by the 1st generation is › low in many fields. We have not ex- erienced any difficulty in timing applica- ons against the 3rd-generation because ırge numbers of moths can be caught in ıght traps and plants infested with nd-generation borers are easy to find.

Summary:

At both test sites, the in-furrow treat- ıents with carbofuran at planting were enerally as effective for control of nd-generation southwestern corn borers ı the foliar applications of carbofuran med to coincide with moth emergence. lso, at Holly Springs, some in-furrow treatments were as effective in reducing damage from 3rd-generation southwestern corn borers and in increasing yield of corn as the foliar treatments. However, at Mississippi State, the in-furrow treatments were not as effective in controlling 3rd-generation borers as the foliar treatments. Thus, response to in-furrow treatments appeared to vary from location to location, probably because of differences in soil types and local climatic conditions.

A combination of in-furrow treatment with carbofuran at planting plus 2 foliar applications timed to coincide with the 3rd-generation southwestern corn borers was as effective in reducing the percentage of plants infested with this insect at harvest as the standard 4 foliar applications timed to coincide with the moth flights of the 1st and 2nd-generations.

The in-furrow treatments with carbofuran were not as effective in reducing the infestations of European corn borer as the foliar treatments at mid-season or at harvest. We did achieve some control of European corn borers with foliar applications timed for control of the southwestern corn borer, but this degree of control may not be considered satisfactory.

Table 1. Summary of results[1] of field tests with carbofuran used for control of 2 and 3rd-generation southwestern corn borers at Mississippi State in 1970-72.

Treatments		% Plants	At harvest		
Method of application[2]	Carbofuran Lb AI/Acre[3]	infested at mid-season	Yield (bu/acre)	% Plants infested	% Plant girdled
		1970			
IF	2	5.5 b	-	-	-
IF	3	2.5 b	-	-	-
IF	4	1.0 b	-	-	-
Untreated check		32.0 a			
		1971			
IF	1	9.0 b	65.0 a	36.5 a	21.5 a
IF	2	2.0 c	74.8 a	41.0 a	26.0 a
IF	3	3.6 c	78.0 a	37.5 a	24.0 a
FOL					
Granules	0.5/appl.	0.0 c	72.4 a	12.0 b	6.5 b
Spray	0.5/appl.	0.0 c	72.4 a	11.5 b	5.0 b
Untreated check		21.6 a	66.5 a	58.5 a	32.0 a
		1972			
IF	2	0.0 b	61.8 a	33.0 ab	10.0 a
IF + 1 FOL (mid 3rd gen.)	2 + 0.5/appl.	1.5 b	60.0 a	22.5 c	7.0 a
IF + 2 FOL (3rd gen.)	2 + 0.5/appl.	2.0 b	56.3 a	14.0 d	6.0 a
2 FOL (1 mid-2nd gen. + 1 mid 3rd gen.)	0.5/appl.	2.0 b	43.6 a	26.0 bc	8.5 a
2 FOL (2nd gen.) + 2 FOL (3rd gen.)	0.5/appl. 0.5/appl.	2.0 b	52.7 a	14.5 d	5.0 a
Untreated check		10.5 a	53.6 a	39.0 a	12.0 a

[1] Any 2 means not followed by the same letter are significantly different at the level of probability by Duncan's new multiple range test.

[2] IF = in furrow treatment at planting; FOL = foliar treatments timed to coinc with moth emergence.

[3] The amounts applied per acre were calculated on the basis of linear feet of row r acre.

Table 2. Summary of results[1] with carbofuran used for control of 2nd and 3rd-generation southwestern corn borers (also effect on European corn borer) at Holly Springs in 1970-71.

Treatments		% Plants infested		At harvest			
Method of application	Carbofuran Lb AI/acre[2]/	at mid-season SWCB[3]/	ECB[3]/	Yield Bu/acre	% Plants infested SWCB	ECB	% Plants girdled by SWCB
				1970			
IF[4]/	2	0.0 b	45.0 ab	73.0 a	13.0 ab	100 a	3.5 b
IF	3	0.0 b	17.5 b	73.0 a	15.5 ab	99 a	8.0 b
IF	4	5.0 b	20.0 b	77.1 a	12.5 b	77 a	5.0 b
Untreated check		53.0 a	85.0 a	58.0 b	50.0 a	100 a	18.5 a
				1971			
IF	1	25.0 a	40.0 a	80.3 bc	32.0 c	94.0 a	19.6 c
IF	2	10.0 b	32.5 a	106.8 a	16.5 b	82.5 a	9.6 b
IF	3	0.0 b	37.5 a	88.7 ab	6.4 c	76.0 ab	3.6 d
FOL (granuless)[3]/	0.5/appl.	2.5 b	10.0 b	93.8 a	2.4 c	57.0 b	1.0 d
FOL (spray)	0.5/appl.	0.0 b	7.5 b	90.5 a	3.6 c	57.0 b	2.0 d
Untreated check		22.5 a	50.0 a	72.9 c	57.6 a	93.6 a	34.0 a

Table 2 continued.

[1] Any 2 means not followed by the same letter are significantly different at the 5
level of probability as judged by Duncan's new multiple range test.

[2] The amounts applied per acre were calculated on the basis of linear feet of row pe
acre.

[3] SWCB = southwestern corn borer, ECB = European corn borer.

[4] IF = in-furrow treatment at planting; FOL = foliar treatments timed to coincid
with moth emergence.

FOOTNOTES

1/Lepidoptera: Pyralidae

2/ This paper reports the results of research only, mention of a pesticide or proprie-ty product in this paper does not constitute a recommendation or an endorsement of ts product by the USDA.

3/ In cooperation with the Mississippi Agricultural and Forestry Experiment Station, ssissippi State, Miss. 39762. Received for publication.

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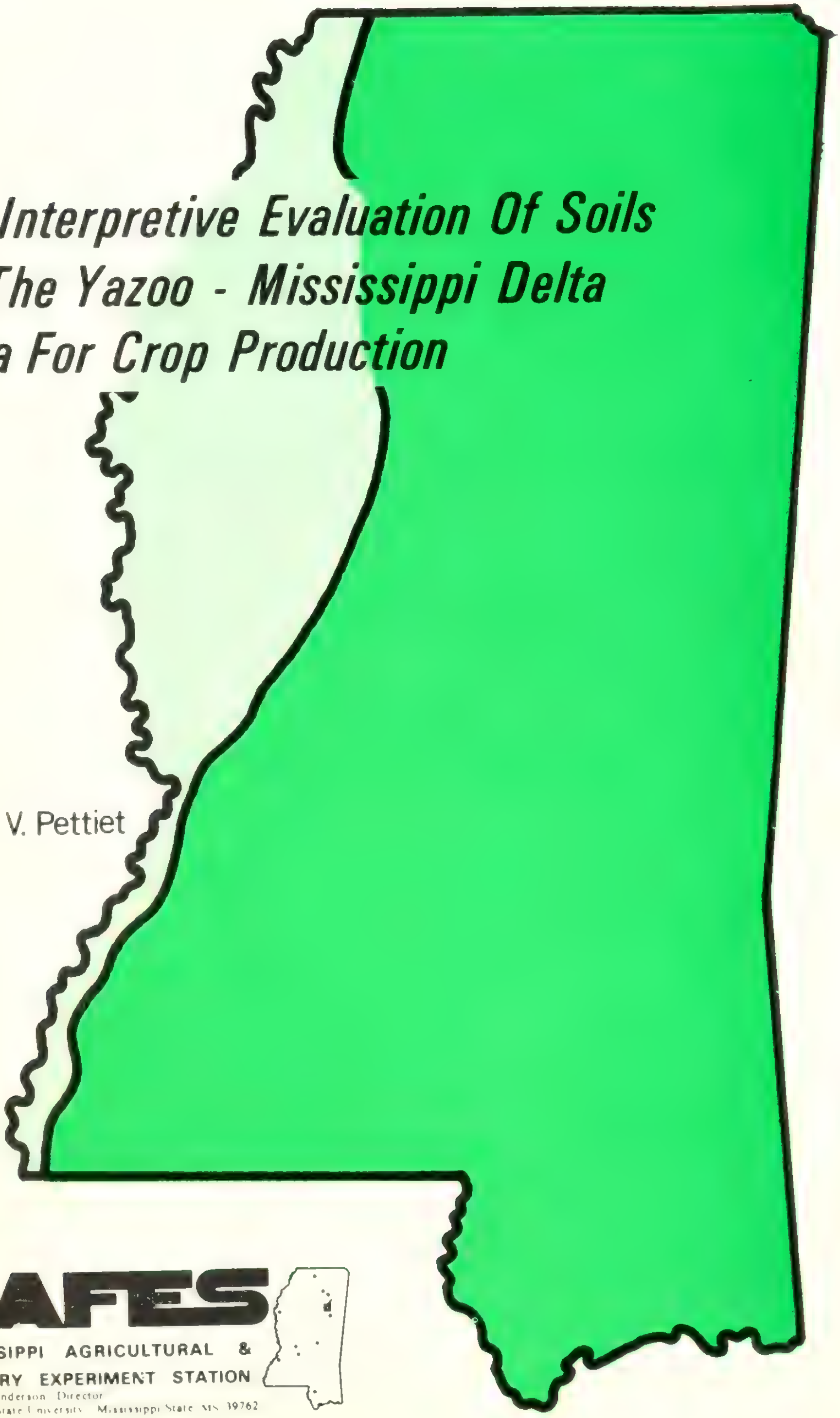

An Interpretive Evaluation Of Soils In The Yazoo - Mississippi Delta Area For Crop Production

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An Interpretive Evaluation of Soils in the Yazoo-Mississippi Delta Area for Crop Production

The Southern Mississippi River Valley is one of the most important areas for crop production in the United States. Approximately 17 million acres of alluvium-derived soils are present within the states of Arkansas, Louisiana, and Mississippi. The crop value in these states exceeds that of crops produced on any area in the nation with similar acreage. Approximately five million acres make up the Yazoo-Mississippi Delta area in Mississippi.

The economy of Mississippi is highly dependent upon the Yazoo-Mississippi Delta since more than 40 percent of the gross annual income is derived from the sale of crops from this area. Despite the high level of crop production, the potential productivity of Delta soils have not been fully realized. This failure has been due in part to the extreme variations in physical, chemical, and mineralogical properties of available soils. While progress has been made in soil management, research workers and farmers lack expertise in modifying the chemical and physical soil properties needed for maximum crop yields.

The Soil Conservation Service, in cooperation with the Mississippi Agricultural and Forestry Experiment Station, has made extensive studies of the Yazoo-Mississippi Delta area, and has characterized the soils present in published Soil Surveys on a county basis (3). The purpose of this report is to supplement information contained in the county surveys, with emphasis on the four million acres of soils described in the 10 all-Delta counties and the Delta portion of Tallahatchie County, Mississippi. It is hoped that this information will provide a wider base for understanding soils in the area and enable farmers to better utilize soil maps contained in county reports on an 'individual' farm basis for better soil management and higher crop yields.

Soil Origin

The Yazoo-Mississippi Delta area is confined to the middle and eastern flood plain of the Mississippi River. The area encompasses ten all-Delta counties and portions of nine counties along the western foothills of the Brown Loam soil area. Delta soils were formed from stream action of the Mississippi, Ohio and Missouri rivers. Sediment carried by these streams came from a watershed encompassing 20 states (1). The highly variable nature of the alluvium was the result of a long and complicated series of shifts in the position of major rivers and tributary streams. Rapid moving water brought sediment into the area. Sand and coarse sediments were first to settle as the streams overflowed their banks. Continuous overflows produced natural levees of coarse sediment near the stream channel; the levees being usually higher in elevation than the surrounding topography. Fine sand and silt sized particles were lost from the overflow water as it moved slowly toward the lower topographic positions. In the lower areas where water accumulates, the finer clay sediments were deposited. In time, the natural levees and stream bed itself were built up to a height above the surrounding flood plain. The meandering stream would then break from its channel and cut a new course toward the lower areas. This process of river migration was continually repeated and in time the Delta became interlaced with meander belts of old abandoned stream channels.

The old channels generally lie between natural levees which grade downslope into fine textured backwater areas. Texture of the downslope sediment grades from coarse sandy loams to fine clays, and internal and surface soil drainage changes from well drained to very poorly drained. The difference in soil drainage was one criteria used to classify the sediment into different soil units. The soil units have many things in common; they have similar parent material and were formed in about the same ti period. They occupy the same relative topographic position (like on the old natural levees) but due to textured makeup, they vary in internal and surface drainage.

Soils in the Yazoo-Mississipp Delta were classified into four main groups (2):

1. Soils of the recent natural levees.
2. Soils of the old natural levees.
3. Soils of the backwater area.
4. Soils of the depressions.

Soils of the recent natural levees are considered the most recent in origin, and are found within a few miles of the present channel of the Mississippi River. Recent sedimen left by the river contained free limestone and the soils were slightly acid to near neutral in reaction. The *Crevasse* and *Robinsonville* soil occupy the highest topographi positions on the recent natural levees. The *Commerce* soils are usually found further from the channe and the *Mhoon* soils are present i the backwater areas.

The old natural levees appea somewhat older than the recent levees and are generally slightly acid t strongly acid in reaction. Soils foun on the old levees in order of decreasing drainage (from excessiv to poorly drained), are *Clack, Beulah, Bosket, Dubbs, Dundee,* an *Forestdale*. The first four soils ar usually found on the higher positions near the old channel. Dunde and Forestdale soils occur on th lower levee positions near backwater areas.

Soils of the backwater areas ar largely fine textured sedimen Locally called "Buckshot soils", the developed under conditions of slo drainage. Differences in the physical makeup of backwater soils are not as evident as soils on the natural levees and to some extent the "Buckshot soils" are classified by soil reaction and soil color, which is nfluenced by differences in the hickness of the clay deposited on the sandy strata underneath. In order of increasing clay thickness, he *Bowdre, Tunica, Sharkey,* and *Alligator* soils, as well as clay soils unclassified) are found in the backwater areas.

The depressional soils occur in he lowest topographic positions. They occupy the old abandoned river channels and tributaries. These soils provide waterways for the slow return of floodwater to the Mississippi river and each year are subject o overflow. In order of decreasing drainage, the *Ark, Souva* and *Dowling* soils occur in the depressions[1].

Other soils of mixed Loess origin occurring near the foothills of the Delta and in Bolivar County, are the *Pearson* and *Brittain* soils on the old natural levees, and the *Collins* and *Falaya* soils in the Loess bottoms. These soils are moderately well to poorly drained.

Soil Distribution

Standard Soil Surveys of Bolivar, Coahoma, Humphrey, Issaquena, Leflore, Quitman, Sharkey, Sunlower, Tunica, Washington, and the Delta portion of Tallahatchie County were reviewed to identify the maor soils present (3). Eighteen soils and certain unclassified acres were found to make up 94% of almost 3.9 million acres in these counties (Table 1). Five soils (Dundee, Forestdale, Sharkey, Alligator, and Dowling) and the unclassified acreages make up 80% of the total land area. These same soils make up the major portion of the unclassified acreages. The soils occupy the low levees and the backwater and depressional areas.

Each soil was classified by surface texture, or the proportion of sand, silt, and, clay sized particles present in the topsoil. Six surface textures were reported: loamy sand, sandy loam, silt loam, silty clay loam, silty clay and clay (3).

Table 2 illustrates the distribution of soils by surface texture, the major soils present within each textural class, and counties with the largest acreages.

The sandy loams - These soils make up 9.17 percent of the Yazoo-Delta. Principal sandy loams in order of acreage are Dundee, Dubbs, and Bosket. The Bosket sandy loams are generally found in the western counties near the Mississippi River. The Dubbs and Dundee sandy loams are well distributed throughout the Delta area.

Silt loams and silty clay loams - These medium textured soils occupy about 25% of the total land area, and Dundee and Forestdale make up 71% of this acreage. The soils are more concentrated in the eastern Yazoo-Delta counties. Sunflower County has the largest acreage of the Dundee and Forestdale silt loams.

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[1] A number of soils that were mapped in the Delta are now inactive and have been absorbed into one or more soil series. For example, the Dowling soils are now considered Alligator or Sharkey depending on soil reaction and color.

Table 1. Percent of Yazoo-Mississippi Delta soils mapped by type[1].

Soil	*Textures present*[2]	*Percent of Delta*
Unclassified[3]	C	18.30
Alligator	SiCL, SiC, C	16.11
Dowling	C	13.03
Forestdale	SL, SiL, SiCL, SiC	11.95
Dundee	SL, SiL, SiCL, SiC	11.13
Sharkey	SL, SiCL, SiC, C	9.90
Dubbs	SL, SiL	3.07
Commerce	SL, SiL, SiCl, SiC	2.49
Tunica	SiC, C	1.83
Bosket	SL	1.66
Brittain	SiL, SiCL	1.04
Collins	SiL	0.91
Falaya	SiL, SiCL	0.68
Bowdre	SiL, SiC	0.44
Souva	SiL	0.41
Pearson	SiL	0.32
Crevasse-Clack	LS	0.23
Beulah	SL	0.21
Robinsonville	SL	0.18
Percent total acreage		93.89
Total acreage = 3,864,900		

[1] **From Standard Soil Surveys of 10 all-Delta counties and the Delta portion of Tallahatchie County.**

[2] **Symbols LS, SL, SiL, SiCL, SiC and C represent loamy sand, sandy loam, silt loam, silty clay loam, silty clay and clay soil textures, respectively.**

[3] **Unclassified areas are primarily clay soils designated as alluvium, clay soil complexes, swamps and miscellaneous areas.**

Silty clay and clay soils - About 60% of the land area is composed of fine textured sediment. Principal soils are Alligator, Dowling, Sharkey, and Forestdale, respectively. The Sharkey soils most frequently occur in the western counties bordering the Mississippi River, with 92% of the total acreage being in Washington, Sharkey, and Bolivar counties. Alligator soils are generally found east of Mississippi Highway 61, and like Dowling and Forestdale, they are well distributed throughout the eastern Yazoo-Delta counties.

Suitability of Soils for Field Crops

An interpretive evaluation of the relative suitability of soils for production of field crops is shown in Table 3. The criteria used to evaluate suitability were physical composition of soils, topographic position, internal and surface drainage, and crop productivity.

The sandy loam soils are generally well suited for most field crops, but moderately rapid water permeability through the soil profile makes them unsuitable for rice. Soybean production on the deep Bosket sandy loams can be limited some

Table 2. Textural distribution of soils within Yazoo-Mississippi Delta counties.[1]

Texture	*Percent of Delta*	*Major soils*	*Soil Drainage*[2] *Class*	*Old Soil Survey Number*	*Percent of Delta*	*Presence and acreages (× 1000) in major counties.*
Sandy loams	9.17	Dundee	SPD	436	3.06	Leflore (30), Coahoma (23), Washington (23), Tunica (13), Bolivar (13), Quitman (12).
		Dubbs	MWD	446	2.80	Tallahatchie (43), Coahoma (21), Leflore (20), Sunflower (10).
		Bosket	WD	456	1.66	Washington (26), Tunica (19), Coahoma (11), Bolivar (5).
Silt loams	12.89	Dundee	SPD	435	4.82	Sunflower (45), Tallahatchie (42), Coahoma (19), Leflore (16).
		Forestdale	PD	425	3.97	Sunflower (59), Bolivar (21), Quitman (18), Humphreys (17), Leflore(17).
		Collins	SPD	535	0.91	Tallahatchie (20), Quitman (7), Leflore (3).
		Commerce	SPD	135	0.81	Bolivar (8), Coahoma (8), Sharkey (7), Tunica (5).
		Brittain	PD	825	0.80	Bolivar (15), Quitman (11), Humphreys (6).
Silty clay loams	12.29	Forestdale	PD	424	6.04	Sunflower (43), Leflore (36), Humphreys (32), Quitman (28), Coahoma (18), Tallahatchie (18).
		Dundee	SPD	434	2.98	Bolivar (31), Coahoma (21), Washington (18), Leflore (12), Quitman (11).
		Alligator	VPD	314	1.23	Leflore (18), Humphreys (11), Tallahatchie (6).
		Commerce	SPD	134	.89	Sharkey (14), Washington (10), Bolivar (5), Coahoma (5).

(table 2, continued)

(table 2, continued)

Texture	*Percent of Delta*	*Major soils*	*Soil Drainage[2] Class*	*Old Soil Survey Number*	*Percent of Delta*	*Presence and acreages (× 1000) in major counties.*
Silty clay	6.29	Sharkey	PD	323	1.69	Bolivar (49), Quitman (14).
		Forestdale	PD	423	1.59	Washington (17), Coahoma (15), Tunica (9), Sunflower (9).
		Alligator	VPD	313	1.58	Sunflower (36), Quitman (23), Bolivar (8).
Clay	53.25	Unclassified	PD-VPD		18.30	Tunica (140), Issaquena (120), Sharkey (96), Bolivar (76), Coahoma (70), Leflore (55), Washington (54).
		Alligator	VPD	312	13.30	Tallahatchie (106), Humphreys (92), Leflore (82), Sunflower (74), Coahoma (38), Washington (37), Sharkey (32), Bolivar (30).
		Dowling	VPD	212	13.03	Bolivar (104), Sunflower (89), Washington (60), Leflore (57), Coahoma (53), Tunica (44), Humphreys (38), Quitman (37), Issaquena (31).
		Sharkey	PD	322	7.62	Washington (139), Sharkey (60), Coahoma (30), Issaquena (25), Sunflower (17).

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[1] **From Standard Soil Surveys of 10 all Yazoo-Mississippi Delta counties and the Delta portion of Tallahatchie county.**

[2] **Soil Drainage Classes WD, MWD, SPD, PD and VPD represent well, moderately well, somewhat poor, poor, and very poor internal and surface drainage, respectively.**

Table 3. Relative suitability of Yazoo-Mississippi Delta soils for production of field crops.[1]

		Field Crops						
Texture-Soil	*Soil no.*	*Cotton*	*Corn*	*Grain Sorghum*	*Soy-beans*	*Oats*	*Wheat*	*Rice*
Sandy loam								
Dundee	436	1	1	1	1	1	1	4
Dubbs	446	1	1	1	1	1	1	4
Bosket	456	1	1	1	2	1	1	4
Silt loam								
Dundee	435	1	1	1	1	1	1	3
Forestdale	425	2	3	2	2	2	2	1
Collins	535	1	1	1	1	1	1	3
Commerce	135	1	1	1	1	1	1	3
Brittain	825	2	3	2	2	2	2	1
Silty clay loam								
Forestdale	424	2	3	2	1	2	2	1
Dundee	434	1	2	1	1	1	1	2
Alligator	314	3	4	2	2	2	2	1
Commerce	134	1	2	1	1	1	1	3
Silty clay								
Sharkey	323	3	3	2	1	2	2	1
Forestdale	423	3	4	2	2	2	2	1
Alligator	313	3	4	2	2	3	3	1
Clay								
Unclassified		4	4	3	3	4	4	3
Alligator	312	3	4	2	2	3	3	1
Dowling	212	4	4	3	3	4	4	2
Sharkey	322	3	4	2	1	2	2	1

[1] **Suitability ratings of 1 = well suited; 2 = suited; 3 = poorly suited; and 4 = not suited, respectively.**

years by drought stress during the late summer; a time when the crop has the greatest moisture requirement.

The silt loams and silty clay loams are suited, to well suited for most field crops. Water losses by infiltration and percolation increases the irrigation costs for rice production on the Dundee, Collins and Commerce silt loams. Rice grows well on these soils, but a lower suitability rating was given because of water permeability. Forestdale and Brittain silt loams and silty clay loams normally produce shallow rooted crops which frequently suffer from drought stress during the summer months. These soils, including Alligator silty clay loam, occupy the lower poorly drained positions, and are hampered by excess moisture in the early spring. The soils are poorly suited for corn, but well suited for rice, and generally suited for other field crops (Table 3).

The silty clay and clay soils are better suited for rice, soybean, and grain sorghum crops. Cotton and corn productions are hampered by the poor physical conditions associated with clay, and by the wet na-

Table 4. Estimated average yields of major field crops produced on Yazoo-Mississippi Delta soils under good management.[1]

	Old Soil	Cotton		Yield in bushels per acre					
	Survey	(#lint/A)			Grain				
Texture-Soil	Number	solid	2 × 1	corn	Sorghum	soybeans	oats	wheat	rice
Sandy loam									
Dundee	436	750	1020	100	65	28	80	35	--
Dubbs	446	800	1080	105	65	27	80	35	--
Bosket	456	750	1040	95	60	26	80	35	--
Silt loam									
Dundee	435	670	840	90	55	28	70	30	--
Forestdale	425	550	680	70	45	23	60	25	90
Collins	535	715	930	95	60	30	70	32	--
Commerce	135	775	1050	100	65	32	72	35	--
Brittain	825	580	720	72	50	25	65	28	90
Silty clay loam									
Forestdale	424	600	720	60	55	26	62	27	90
Dundee	434	650	810	70	60	30	65	28	85
Alligator	314	500	625	55	50	22	57	24	90
Commerce	134	700	910	80	65	32	70	32	--
Silty clay									
Sharkey	323	500	575	60	55	31	60	27	100
Forestdale	423	500	575	50	50	26	60	25	95
Alligator	313	470	540	45	50	25	55	22	95
Clay									
Unclassified	-	-	-	-	-	-	-	-	-
Alligator	312	450	515	40	45	24	55	20	100
Dowling	212	250	270	10	25	15	10	5	90
Sharkey	322	480	550	55	50	30	60	25	105

[1] **Derived from the Standard Soil Surveys, Mississippi Agricultural Experimentation Bulletins and Information Sheets, and from personal experience with Delta soil types. Except for rice, all yield levels are for non-irrigated crops.**

ture of these soils. Dowling and the unclassified clays are generally subect to flooding after heavy rains and, in general, should not be used for cotton, corn, oats, and wheat production.

Estimated Crop Yields by Soil Type

An estimate of present average yields for the major field crops produced on Yazoo-Mississippi Delta soils are shown in Table 4. The well, o moderately well drained sandy oam soils have higher yield levels or cotton, corn, oats, and wheat. Yield differences between sandy oam soil types are somewhat indicative of their ability to supply moisure for crops through the dry summer months.

Soil compaction, slow internal drainage, and shallow topsoil depth have the greatest influence on yields of silt loams and silty clay loams. Commerce, Collins, and Dundee soils occupy somewhat higher topographic positions which generally allows deeper root systems. The Commerce soils were judged best for crops other than rice because of their inherent natural fertility nd high water holding capacity.

The effective rooting depths of plants and yields are influenced by he physical and chemical nature of he various soils. Current use of deep tillage practices increases the ooting depths of plants in the sandy oams, silt loams, and silty clay oams. The subsoil plow tends to reduce yield differences in these soil ypes.

Sharkey silty clay and clay soils are considered more productive han similar Alligator soils due to higher natural fertility, higher organic matter levels, and better tilth in he topsoil. Crops on Dowling and many unclassified soil areas in the depressions suffer from excess water in the spring, late planting, poor plant stands, and/or flooding prior to harvest. Production is not economically advisable on these soils for crops other than rice, soybeans or grain sorghum. However, many of the unclassified acreages do not fall into this group. At the time the soils were mapped, the unclassified areas were woodland or covered with water and were not considered suitable for crop production. Many areas have since been drained and cleared, and are considered relatively productive.

Summary

Soils of the Yazoo-Mississippi Delta area were formed from alluvial materials from the Mississippi, Ohio, and Missouri rivers. Approximately four million acres of highly productive soils are present in the 10 all Delta counties and the Delta portion of Tallahatchie County. Ten percent of the land area is composed of sandy loam soils, 30% of silt loams and silty clay loams, and 60% of silty clay and clay soil types.

The Dundee, Forestdale, Alligator, Dowling, Sharkey, and unclassified acreages make up 80% of the total land area. These soils are found on the lower levees, backwater and depressional soil areas. Dundee and Dubbs are the major sandy loams, Dundee and Forestdale the major silt loams, Forestdale and Dundee the major silty clay loams, and Alligator, Dowling, and Sharkey the major clay soils, respectively.

Most sandy loam and silt loam soils are suited for production of most field crops except rice. The silty clay loams are suited for all crops, including rice. The silty clays and clay soils are better suited for soybeans, grain sorghum and rice.

Estimated average crop yields vary by soil type, as suggested by the crop suitability ratings. The sandy loam soils have high yield levels for cotton, corn, oats, and wheat. Soil compaction, slow internal drainage and shallow-rooting reduce the yields of these crops on the silt loams and silty clay loam soil types, but this can be partially overcome by deep tillage.

Sharkey silty clay and clay soils are considered more productive than similar Alligator soils. Crops on the Dowling and many unclassified soil areas suffer from flooding after rains, therefore production is not advisable for crops other than rice, soybeans and grain sorghum.

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BULLETIN 809

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Comparison Of
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50 To 1970

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Bulletin No. 809

MISSISSIPPI'S FARMING AND NONFARMING POPULATION A COMPARISON OF CHARACTERISTICS AND TRENDS 1950 TO 1970

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April 1974

MISSISSIPPI'S FARMING AND NONFARMING POPULATION
A COMPARISON OF CHARACTERISTICS AND TRENDS
1950 TO 1970

While state and nation are currently gaged in consideration of potential agri- ltural scarcities and rising food prices, ere are recent indications that the size the United States farm population may ceasing to decrease. For the first time more than 20 years, the size of the ation's farm population maintained lative stability for two successive years 4.6 percent of the total population cording to a recent publication from e U. S. Bureau of the Census giving esti- ates of the farm population for 1971 d 1972.[1] It may be that these events rtend a change in farm population ends and a new emphasis on the signifi- nce of the nation's agricultural enter- ise.

In view of such future possibilities, a view of recent statistics describing ississippi's farm population should be of gnificant interest. This report will in- stigate and describe trends and changes r Mississippi farms, farmers and farm opulations for the period between 1950 d 1970, and will compare the farm opulation with that of urban and rural nonfarm segments in terms of growth trends and 1970 characteristics. Data on which the report is based are drawn from both the Censuses of Agriculture (taken at 5-year intervals, the last of which was taken in fall of 1969) and the decennial Censuses of Population and Housing (the last of which was taken in April, 1970).[2]

What have been the overall trends for Mississippi's farm population over the past twenty years, and particularly, what are its unique characteristics today? Traditionally, Mississippi has been oriented toward farming, both as an economic enterprise and as a way of life, but sweeping changes have overtaken the state in the last twenty years. In 1950, half of her population lived on farms, nearly 70 percent of her land was used in farming, and 40 percent of her labor force was engaged in farming,[3] but by 1970, Mississippi had moved very close to national modes of population and occupational distribution. According to the latest census, only 9.5 percent of her population is now classed as farm residents (as compared with 4.8 percent for the nation), and only 6.4 percent of her labor forces (as compared to 2.8 percent for the nation) are engaged in farming.[4] These changes in the proportions of the state's population involved in farming—changes which were probably an inevitable outcome of the modernizing trend in agriculture—have resulted from an unprecedented movement and relocation of large sectors of the state population, and, along with these movements, impressive changes in levels of living and life styles.

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[1] U. S. Bureau of the Census *Farm Population*, Series Census-ERS, P-27, No. 44 (June, 1973), p.

[2] The population bases used to describe the current characteristics of Mississippi farm population ere the 72,577 farms and the 52,210 farm families enumerated, respectively, by the agricultural nsus of 1969 and population and housing census of 1970. The approximate 20,000 difference etween farms in 1969 and farm families in 1960 may be explained in part by difference in type of nit used and in part by continued loss of farm population. A farm does not necessarily contain a ousehold unit or a family. In addition to families, Mississippi had 5,986 households of unrelated or rimary individuals and 2,651 subfamilies enumerated in the 1970 census. Differences in the popula- on bases need not be a problem here, inasmuch as the interest is chiefly in the characteristics which escribe them.

[3] See Table 1 and the U. S. Bureau of the Census, *1950 Census of Population* Volume 11, Part 4 (Washington, D. C.: USGPO), Table 26.

Farm and Nonfarm Population Trends

While total population figures have remained deceptively unchanged (a slight 1.74 percent increase in twenty years) the farming population of the state has decreased 80 percent, the number of farms and farming units have decreased more than 70 percent, the urban population has increased 62 percent, and the rural nonfarm sector has grown by about 115 percent—a farm-to-nonfarm population transition which has effected a net occupational relocation of about 40 percent of the state's population in the twenty year period.[5]

County Distributions of Growth Trends

Equally as impressive as the high rates of change in the state's farm and nonfarm population segments is the extent to which the rural population change blankets the entire state. See maps in Figures 1, 2, and 4 and Table 5, clin numerical data and percent change for counties. Only three counties decreased less than 70 percent in farm population during the 20 year period, and in many cases, losses were greater than 90 percent. Geographically, there were more counties in the northeastern corner and eastern half than in other sections of the state with below average farm population losses. However, rates of loss did not vary extensively by region. In the change in the number of farms (and farmers) as recorded by the agricultural censuses (Figure 4) a geographic pattern is visible, and the Delta shows up as the region of heaviest loss. However, the loss trend is a matter of degree rather than of fundamental pattern. The Delta, with its extensive farming operations, and originally more numerous farm population is more adaptable to mechanization and more visible in terms of population outmovement, even though its rates of change for the various residence segments are not impressively different from those in other regions of the state.

In the rural nonfarm sector, all but six counties increased at least 50 percent, and in some cases, growth quadrupl (Figure 2). Again, no distinct geograp pattern appears in the net rates of growth. In fact, even for the two race groups, the general patterns seem to apply; although, on the average, nonwhites had higher farm loss rates and lower nonfarm growth rates than c whites. In most counties, both races experienced rural nonfarm growth rates which exceeded their loss rates for fa idents although only in a few cases did merical nonfarm growth recover or ex- ed the farm losses. Furthermore, such s recoveries occurred almost exclu- ely among the white populations in or ar leading urban centers and may be ore of a factor in dispersion of urban owth than in stabilization of rural pulation distributions.[6]

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[4] U. S. Bureau of the Census, *1970 Census of Population, Detailed Characteristics,* Report N PC(1)-D26 (Washington, D.C.: USGPO) Tables 138, 173, and 174; PC(1)-C1, Table 81; *Farm Popu tion,* Series Census-ERS, P-27, No. 44 (June, 1973), p. 1.

[5] See Tables 1 and 5.

The growth of the state's rural non- m population is both interesting and igmatic, in that it undoubtedly incor- rates several types of growth. In one spect, it can be seen as rural growth hich counteracts the state's extensive m population loss and may simply be a ange of occupation rather than a ange of residence. But, as indicated ove, rural nonfarm population growth ust also be seen as containing a burban and possibly an ex-urban com- nent, the latter resulting from a flight affluents from town to country tates. Thus, it represents a form of odern population growth which is an ternative to urban concentration and ntralization.

The distribution of urban population owth is less uniform, and identifying a finitive pattern of change is even more usive than it was for the state's rural gments. Actually, the urban growth nnot be explained in itself, but must so (even more so than for the farm opulation) be looked at in terms of how relates to rural nonfarm trends. Urban sidence is based on politically defined oundaries, and its growth depends to a rge extent on the happenstance of olitical annexation. As the map (Figure shows, twenty-three counties were still efined as totally rural in 1970, although another fifteen had moved from this category between 1950 and 1970 and had an urban component at the later date. Five counties lost urban population, and the remaining thirty-nine increased at varying rates. Comparison of the maps and study of Table 5 shows that in many counties loss or small growth of urban population was offset by a significant rural nonfarm increase.

Farmer and Farming Trends

However, changing population and occupational distributions give only a partial description of changes that have been occurring in Mississippi's rural populations, her farming enterprise, and her farm population. Tables 1 and 2, drawn from the agricultural censuses, give statistical summaries of changes in characteristics of Mississippi farms, farmers, and farm industry. Tables 3 and 4, drawn from the population and housing censuses, compare 1970 population characteristics for the state's urban, rural nonfarm, and rural farm populations.

While the state's farm population has been drastically reduced in size since 1950, the amount of land used in agriculture has remained relatively high. As Table 1 shows, the 1969 Census of Agriculture enumerated less than one-third as many farmers in 1969 as were counted in 1950, but the amount of acreage the state devoted to farming was about 80 percent of the 1950 amount. This trend toward a lower farm population density is also reflected by the fact that average size of a farm in 1969 was two-and-one-half times the 1950 average size, having increased from 81 to 221 acres.

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[6] See, for instance; Adams, George, Green, Grenada, Hancock, Harrison, Jackson, Jones, Lamar, awrence, Lowndes, Marshall, Pearl River, Perry, Rankin, and Warren Counties in Table 5.

The overall picture given by these statistics and those that follow is a rapid change in Mississippi from a labor-intensive small farm system with high proportions of tenancy to large-scale mechanized farming with predominantly ownership tenure. The proportion of full owners among Mississippi farmers in 1969 was nearly twice that found in 1950, and the farm tenancy percent was cut by 80 percent. Not only was farm population loss disproportionately concentrated in the tenancy group, it was especially pronounced among black tenants. Table 1 shows, also, that while the proportions of owner-operators who are black remained relatively constant over the 20-year period, the percent of the tenant group who are black changed from 72.5 percent in 1950 to 41.8 percent in 1969—or from a predominantly black to a predominantly white group. Part of the decrease in the proportion of tenancy, however, can undoubtedly be accounted for by increased use of hired farm workers. While the last agricultural census does not give data on the number of hired farm workers as earlier censuses did, it does show that the proportion of farms using hired help increased more between 1964 and 1969—from 41.2 to 49.6 percent—than in any of the preceding periods.

Thus, the model 1970 Mississippi farmer, as contrasted with his 1950 version, may be described as typically white and typically an owner-operator. In terms of age, he averaged eight years older than he did in 1950; and, in fact, 22 percent of his number was past retirement age as compared with 13 percent 20 years earlier. The 1970 farmer was also more likely than his 1950 predecessor to live somewhere else than on the farm he operated (16.6%) or to be working the farm he operated (44.0%). Howe the proportions of farms classed as p time or retirement did not change signi cantly between 1959 and 1969, th combined percents ranging between 13 and 47 percent.

While somewhat difficult to ass part-time farming, as well as occupa and residence patterns which comb town and farm components are appar ly a continuous and possibly an increa type of adaptation to changing orga tion of the agricultural enterprise. It long been thought that part-time farm was used by many as a means for lea agriculture and entering the non-f labor force. This may still be the case it may be that these farm and non-f combinations of work and reside patterns are a way of adopting an ur life style without giving up profitable enjoyable agricultural operations.[7] Ta 3, which compares the 1970 industry tribution of the farm resident work fo with that for urban and rural nonfa groups, also substantiates the thesis t town and country residence, occupati and life style patterns are interwoven a interdependent. Data from this table discussed further below.

Farm Operation Change

Table 1 also gives a thumbnail ske of changes in the nature of farming ope tions in the state over the 1950-to-19 period. While the proportion of Missis pi farmers engaged in commercial farm enterprises has remained relatively changed, the level of operation, the m of farming enterprises and degree mechanization have not. Corpora

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[7] Ellen S. Bryant and Kit Mui Leung, *Mississippi Farm Trends, 1950-1964*, MAFES Bullentin 754 (December, 1967), pp. 5-6.

BLE 1 - CHARACTERISTICS OF MISSISSIPPI FARMS AND FARM OPERATORS, 0 TO 1969

Characteristic	1969	1964	1959	1950
F mers				
Number	72,577	109,141	138,142	251,383
Percent change per period	-33.5	-21.0	-45.0	-4.6[a]
Full owners				
Percent of total	72.3	59.2	54.0	41.0
Percent white	76.7	77.6	76.4	77.4
Percent nonwhite	23.3	22.4	23.6	22.6
Tenants				
Percent of total	9.0	23.5	32.3	51.6
Percent white	59.6	27.5	27.8	27.5
Percent nonwhite	40.4	72.5	72.2	72.5
Percent 65 and over	22.1	20.1	18.0	13.1
Median age	54.1	52.8	51.2	46.2
Percent working off their farms[b]	44.0	34.0	29.9	17.5
Percent residing off farm operated	16.6	7.5	5.0	2.9
Farms				
Number	72,577	109,141	138,142	251,383
Percent of land area in farms	53.0	58.7	61.6	68.5
Average acres per farm	221.0	162.6	134.9	82.4
By economic class				
Percent commercial[c]	37.3	33.0	29.1	NA
Percent part-time	29.9	26.6	31.4	NA
Percent part retirement	16.6	16.7	15.5	NA
Percent using hired workers	49.6	41.2	36.8	32.3
Percent with income from:				
Customwork and agricultural services	7.4	NA	NA	NA
Recreational services	1.1	0.3	NA	NA
Government farm programs	44.1	NA	NA	NA
Percent of commercial farms[c] with:				
Corporate ownership	1.5	NA	NA	NA
Sales of $100,000	4.2	3.4	NA	NA
Percent of state's farm income from:				
Crops	44.8	64.8	61.3	74.0
Forest products	1.3	1.0	1.6	2.0
Livestock and their products	54.0	34.2	36.8	24.0

(continued on page 6)

Characteristic	1969	1964	1959	195
Percent with:				
Telephones	NA	40.2	26.7	6.5
Home Freezers	NA	66.4	42.6	4.5
Automobiles	60.4	65.1	52.8	26.8
Trucks	69.3	55.5	44.5	20.0
Tractors (not garden)	69.4	47.5	37.2	12.9

a. Percent change, 1945 to 1950.

b. 100 days or more

c. Farms with sales of $2,500 or more.

SOURCES: U. S. Bureau of the Census, *Census of Agriculture, 1969,* **Vol. 1, Part (Washington, D. C.: USGPO), Tables 3, 4, 6, and 12;** *1964,* **Table 1, 3, 4, and 5;** *19* **Table 4;** *1950,* **Vol. 1, Part 22, Part A, Table 16.**

ownership characterized 1.5 percent of Mississippi's farms in 1969 and 4 percent had sales of more than $100,000. Further, nearly 70 percent of Mississippi's farms were equipped with tractors in 1969, whereas, in 1950 only 13.3 percent were. The sources of farm income shifted noticeably away from crops and to livestock between 1950 and 1969 and, in addition, other important sources of income were reported for the first time at the later date. These were government farm programs, from which 44.8 percent obtained income, agricultural custom and service work, from which 7.4 percent received income, and recreational services, just barely measurable at 1.1 percent.

Agricultural census statistics on farm units in terms of crop and livestock production are not as easy to evaluate as the statistics discussed in the above paragraph; however, they bear out the same trends and fill in some interesting details. For instance, Table 2 shows that 73.4 percent of the state's farms harvested crops, even though only 44.8 percent of the state's farm income came from sales of crops (Table 1). Similarly, the proportion of farmers with livestock was higher than the proportion of the state's farm income from livestock. It is interesting note that in many cases the percent farms reporting raising a particular k of crop or livestock has declined rat than increased. Exceptions are soybe sorghum, vegetables, and broilers. P duct specialization seems to be one of developing trends among Mississi farmers.

Farm Levels of Living

Farm levels of living, in terms of c veniences, also seem to be noticeably proved, although the data given are so what limited. Tables 1 and 4 both c tain some of these items. Automot transport seems to be accessible to t vast majority of farmers, in that 60 p cent reported having automobiles and percent reported having trucks. Wh some truck owners undoubtedly also h autos, it does not seem reasonable to sume a 100 percent overlap. The 19 population census also gives data indi ting automotive affluence for Mississip farmers, showing that 27 percent h more than one automobile available. T proportion was somewhat higher th that for the rural nonfarm category, a

ABLE 2 - PERCENT OF FARMS RAISING VARIOUS TYPES OF CROPS AND VESTOCK

MISSISSIPPI, 1950 TO 1969

Product	1969	1964	1959	1950
l farms				
Number	72,577	109,141	138,142	251,383
Percent	100.0	100.0	100.0	100.0
Percent harvesting cropland	73.4	80.8	85.6	91.3
Percent harvesting:				
Corn (all purposes)	32.4	52.4	66.8	74.0
Sorghum (grain or seed)	0.6	0.2	0.4	0.2
Grain Wheat	1.4	1.7	0.9	0.2
Soybeans (for beans)	17.3	8.0	7.0	1.7
Hay^a	30.2	NA	NA	NA
Cotton	39.4	46.5	56.0	75.9
Peanuts (for nuts)	3.8	4.9	4.6	4.9
Land in orchards	3.7	5.9	7.8	30.3
Vegetables for sale	5.1	4.1	4.8	4.3
Percent with:				
Cattle and Calves	70.0	76.4	72.6	67.9
Milk Cows	18.5	34.4	47.4	61.2
Hogs and Pigs	23.4	39.5	62.3	67.4
Sheep and Lambs	0.6	0.7	1.0	0.5
Chickens^b	22.6	50.8	70.0	83.4^c
Broilers^d	2.4	NA	NA	NA

a. Excludes sorghum hay.

b. Includes chickens three months and older.

c. Includes chickens four months and older.

d. Includes meat-type chickens less than three months old.

NOTE: NA indicates data are not available.

SOURCE: Computed from data in U. S. Bureau of the Census, *Census of Agriculture, 969 Mississippi,* **Vol. 1, Part 33 (Washington, D. C.: USGPO) Tables 7 and 8;** *1959,* **able 6 and 8.**

urprisingly close to the urban population's 34.2 percent. The agricultural census of 1964 reported that the percent of wnership of telephones and freezers mong Mississippi farmers had increased o 40.2 and 66.4 percent, respectively. Vhile the 1969 agricultural census does ot report these figures, the population ensus for 1970 (Table 3) gives the perent of ownership among farm households of freezers at 71.5 percent. Television ownership was reported for 90.6 percent of farm housing units. The urban population, by comparison, has a slightly higher rate of television ownership (93.1%) but a much lower rate of food freezer ownership (34.3%). The state's farm population was also ahead of its urban counterpart in terms of having clothes dryers and dishwashers.

Rural and Urban Population Characteristics

Nevertheless, in spite of changes, a sizeable proportion of farm households in Mississippi retained some of the characteristics typically associated with low-income rural populations. Following the tabulation on possession of appliances in Table 3 are statistics on households lacking flush toilets and piped water. It can be seen that about one-fourth of all rural households lacked piped water and about one-third lacked flush toilets.

Farm and urban differences also show up among education and economic characteristics. Farm families had lower median family incomes, lower educational and vocational training levels, and higher proportions of its families below the poverty level than nonfarm families. However, it is the Negro farm category where income and education levels were lowest and poverty levels highest. In fact, these statistics indicate that persistence of low socioeconomic levels in Mississippi seems to be much more a problem of the Negro family than of the farm family, per se. Comparing the category of highest Negro family median income (urban at $3,865) with the lowest white (rural farm at $5,890) the latter is seen to be 50 percent higher than the former. Similarly, the differences in proportions below the poverty level were much greater in the white-black comparisons than in the urban-farm comparisons. More than two-thirds of all rural black families, whether farm or nonfarm, were classed as having incomes below poverty level. In urban areas, close to half were below this level. Whites, on the other hand, had 10 percent of their urban families and about percent of their rural families at bel poverty level.

Female participation in the labor fo was noticeably lower in the farm tha the urban and nonfarm populations. fact, for all groups display (whet white, Negro, total female labor force, mothers with small children under s there is a progressive decline as one mo from left to right in the table (from urb to farm). Reasons for these differen cannot be detected from these data. can only be surmised that the variatio may be related to differential family si a higher average age for farm wives, volvement of family workers in unpa farm labor, or perhaps isolation fro access to job market areas. It is al possible that the lower proportions rural women engaged in gainful work h an effect in helping hold farm family comes at their comparatively low level.

Perhaps the most interesting of t entries in Table 3 are those giving t proportions of the work force in t various residence categories employed agriculture, mining, construction, a manufacturing.[8] While the rural fa population did indeed have the high proportion of its work force engaged agriculture, it is somewhat surprising th only about one-third of it was employed. It is also interesting to no that the farm population contribut very nearly the same proportions to t other labor force categories listed as t urban population did. The low median i come of farm families was of necessi drawn from more than farm source What it would have been without su

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[8] It should be noted that work force includes all employed family members, and while the majo breadwinner may be a fulltime farmer, several other family members may have nonfarm jobs.

ble 3 SOCIO-ECONOMIC CHARACTERISTICS OF URBAN AND RURAL SIDENTS

MISSISSIPPI, 1970

Characteristic	Urban	Rural Nonfarm	Rural Farm
cent of Occupied Housing Units With:			
Two or More Automobiles	34.2	26.5	26.9
Clothes Washing Machine	66.7	68.2	76.1
Clothes Dryer	30.8	21.3	22.3
Dishwasher	16.9	7.7	6.7
Food Freezer	34.3	53.3	71.5
Television	93.1	89.9	90.6
hout:			
Piped Water	2.0	24.6	26.9
Flush Toilets	3.3	30.9	33.5
cent of Work Force 16+ Employed in:*			
Agriculture, Forestry and Fisheries	1.6	8.7	34.4
Mining	.8	1.4	.8
Construction	6.6	8.7	6.7
Manufacturing	20.5	32.5	23.8
dian Family Income	7300	5309	4356
White	8883	6696	5890
Negro	3865	2856	2407
cent of Families Below Poverty Level	21.2	35.1	36.1
White	10.2	20.9	21.0
Negro	49.1	67.2	66.9
dian Years of School Completed			
Males 25+	12.1	9.1	8.8
White	12.5	10.8	10.6
Negro	7.7	6.0	5.5
Females 25+	12.0	9.9	10.0
White	12.4	11.3	11.4
Negro	8.6	7.7	7.5
rcent of Persons 16-64 with Vocational Training**			
Male	22.8	17.3	14.1
Female	16.4	11.4	9.0
rcent of Females in Labor Force 16+			
All	44.1	35.1	29.1
White	42.7	36.5	32.0
Negro	47.2	32.5	24.3
With Own Children Under 6	44.1	38.0	30.2
White	36.9	36.2	30.6
Negro	58.1	41.3	29.8

(continued on page 10)

*In numbers, the urban work force - 351,496; rural nonfarm - 305,443; rural fa 62,009

**With less than 15 years of school.

SOURCES: U. S. Bureau of the Census, *1970 Census of Population, General Sc and Economic Characteristics,* Report No. PC(1)-C26 (Washington, D. C.: USG Corrected Tables 53, 55, 57, 58, and 51; *1970 Census of Housing, Detailed Hou Characteristics,* Report No. HC(1)-B26, Corrected Tables 31 and 32.

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sources is impossible to know from these data. However, it would almost certainly have been lower than reported. It is also worth noting that it was the state's rural nonfarm rather than its urban population that was the most significant contributor to the state's manufacturing work force.

Traditional urban-rural fertility differentials were also apparent in a limited way in the 1970 population of the state. As Table 4 shows, farm populations tended to have slightly higher average family sizes than urban residents, but slightly smaller ones than the rural nonfarm category. In all residence groups, the female headed families had the highest average. Farm families had the largest percentage of the very large families. Better than 13 percent of families had seven or more members compared to 8 percent for urban families. Similarly, fertility levels, as measured by the cumulative statistic of number of children ever born to women at or past child bearing ages, were higher in rural areas and highest for the rural farm population. However, differences were larger within the Negro than within the non-Negro population. For the first group, farm mothers have averaged 1.8 more children per woman than their urban counterpart. In the non-Negro population, the average difference per mother is .7 children.

In the 20 through 24 age group, differences in the number of children ever born to urban and rural women were considerably less. Here, differences between urban and farm groups for Neg averaged only .5 children per mot while the non-Negro group showe variation of only .3 children per mot The highest black rates still occurre the farm population, but for n Negroes, rural nonfarm fertility slightly higher than that for the f group. If one can assume that differences between the number of bi for the 20-24 year group and the t 15-and-over group are indicative of a c tinuing trend, it is reasonable to pre that within the near future birth rates rural and farm families will not di from those for families living in the c

Summary and Conclusion

Mississippi's farm population has perienced dramatic changes during twenty-year period between 1950 1970. Outstanding improvements in fa mechanization, ownership tenure, au motive transportation, and possession convenience appliances have been not However, some problems remain. Ab 25 percent of rural housing, both fa and nonfarm, still has deficiencies in most essential of all home convenience piped water. An even larger percent la flush toilets.

Rural life styles, as measured by come and education levels, approaching those of the urban reside for the state's white population. But, black farm population continues to hibit the lowest income and educati

TABLE 4 - FAMILY AND FERTILITY CHARACTERISTICS FOR URBAN AND RURAL RESIDENTS MISSISSIPPI, 1970

Characteristic	Urban	Rural Nonfarm	Rural Farm
mber of Families[a]			
Total	240,340	241,894	52,210
White	171,711	167,419	35,099
Negro	68,192	73,815	17,063
mber of Subfamilies[b]			
Total	9,372	11,601	2,651
White	3,499	4,433	1,086
Negro	5,858	7,125	1,549
erage Size of Families			
All	3.68	3.98	3.94
Husband/Wife	3.67	3.99	3.93
Female Head	3.75	4.07	4.16
rcent of Families with 7+ Members	8.0	12.2	13.3
rcent of Families with Head Only in Labor Force	38.8	36.3	37.7
umber of Children Ever Born Per 1000 Women Ever Married Aged:			
15+			
Total	2,634	3,368	3,744
Non-Negro	2,319	2,854	3,063
Negro	3,383	4,495	5,137
20-24			
Total	1,123	1,470	1,613
Non-Negro	903	1,214	1,189
Negro	1,804	2,206	2,339

a. A family is a group of two or more people residing together who are related by lood, marriage or adoption. All such persons are considered one family even though hey may include a subfamily.

b. A subfamily is a married couple or a parent-child group related to and sharing the iving quarters of the family head.

SOURCES: U. S. Bureau of the Census, *1970 Census of Population, Detailed haracteristics, Mississippi,* **Report No. PC(1)-D26 (Washington, D. C.: USGPO) Table 157, 158, and 161; Report No. PC(1)-C26, Corrected Table 52.**

evels of all the groups examined. However, urban blacks are not impressively etter off than farm blacks, and these ata give strong support for the conclusion that rural farm poverty in Mississippi is not so much a problem of inefficient agricultural production as it is a problem of a disadvantaged minority group, many of whose members have not yet made sufficient economic and educational achievement to be classed as average Mississippians.

Small and seemingly residual urban-rural differences were found for family size, fertility ratios, and female participation in the labor force, indicating, perhaps, a somewhat greater tendency for persistence of a family-centered life style among rural than among non-rural populations.

In terms of future population distributions and their economic and political impact, the most significant pattern suggested by this statistical description of Mississippi farm population is the trend toward mixing farm and off-farm occupations and residences. Farmers do not necessarily live on their farms; the majority of the employed persons living on farms work at nonfarm occupations. Thus, many Mississippians have adapted to the state's changing economic and technological bases by combining aspects of the agricultural and the urban-industrial occupations and activities. The life style they have developed are dependent on both agricultural and nonfarm bases; and the interdependence of town and country has become more than a symbiosis of industries; it has penetrated the household unit an individual breadwinners. The days of a clearly defined farm block as well as the community-bounded rural way of life may be over. Industrial interdependence has established farm-to-factory commuting and urban types of co veniences for the rural Mississippian. these kinds of occupational and residenc patterns continue, it would seem tha population distribution patterns could b kept relatively flexible, and Mississip may in the future be able to avoid dens urban concentrations which characteri so much of the nation.

However, while impressive social an economic changes have occurred amon Mississippi's farming population and th future mix and distribution of rural an urban populations and occupations a promising, the most dramatic (and th most meaningful in terms of impact o individual human lives) aspect of th twenty years of change in Mississippi population has been the tremendous r duction in the size of the state's farmin population. In the space of two decade the state's agriculture has changed fro an essentially self-sufficient family far type of production to one which essentially of an industrial-commerci nature, efficiently maintained by a muc smaller expenditure of manpower.

Whether or not farm population siz has reached its lowest level or whether will continue to decline further will n be known for several years. However, th rate of decline as experienced during th past twenty years cannot continue an loss rate must level off if the state agr cultural enterprise continues to develo and proceeds to participate in a growin international market for farm product

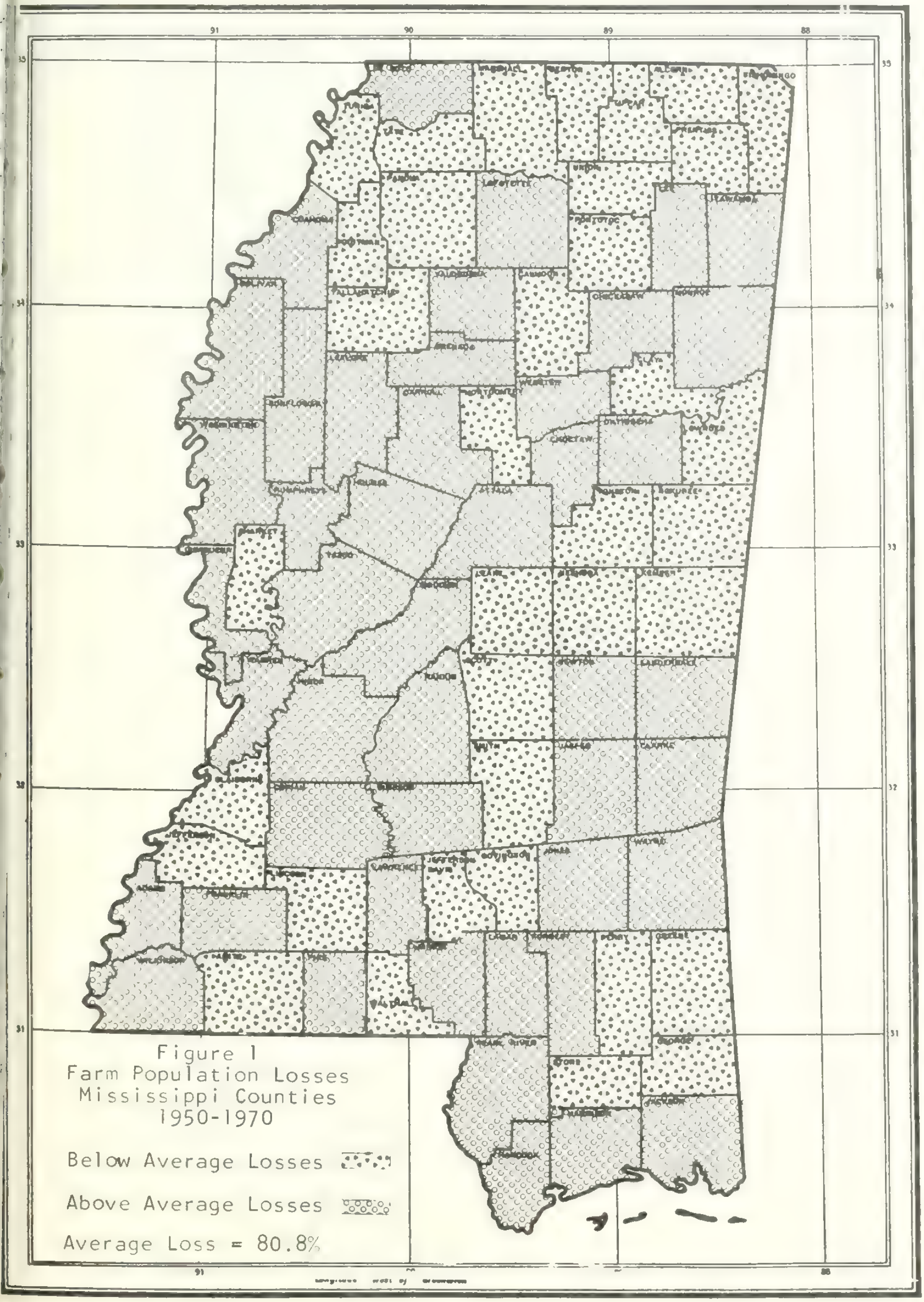


Figure 1
Farm Population Losses
Mississippi Counties
1950-1970

Below Average Losses ⁘

Above Average Losses ▨

Average Loss = 80.8%

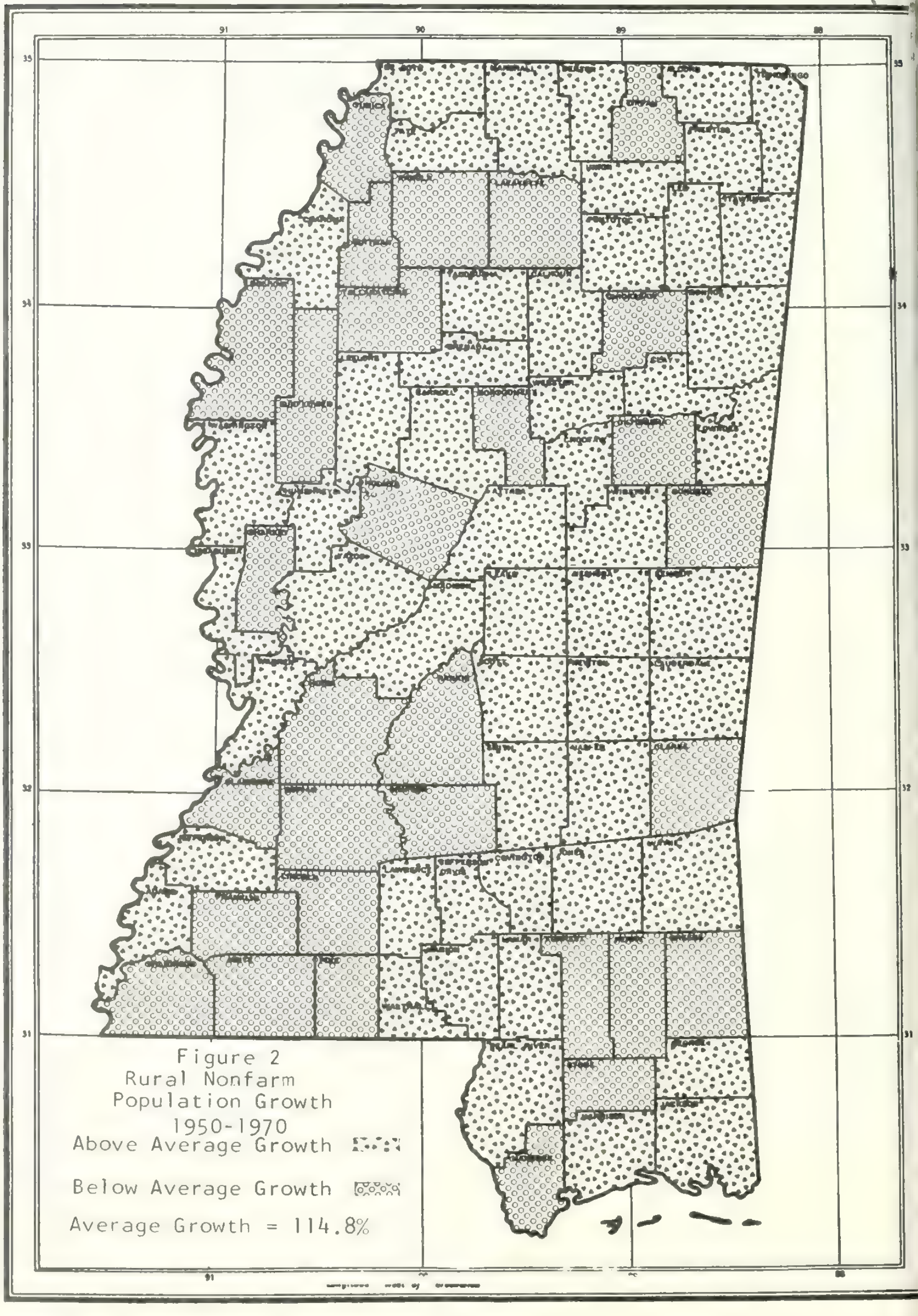
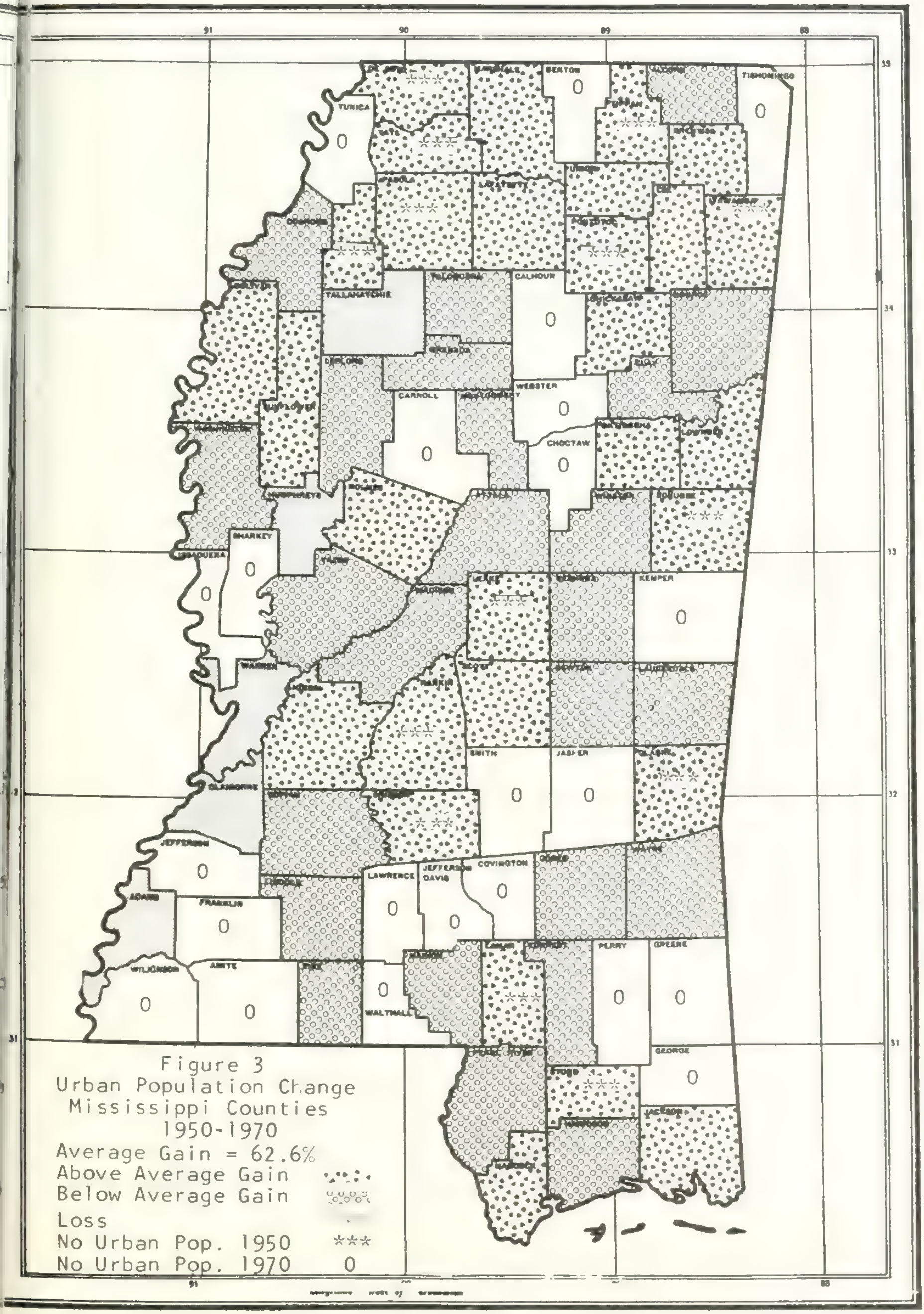


Figure 2
Rural Nonfarm
Population Growth
1950-1970

Above Average Growth ░

Below Average Growth ▒

Average Growth = 114.8%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WARREN
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SMITH
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LAWRENCE
JEFFERSON DAVIS
COVINGTON
FRANKLIN
WILKINSON
AMITE
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GREENE
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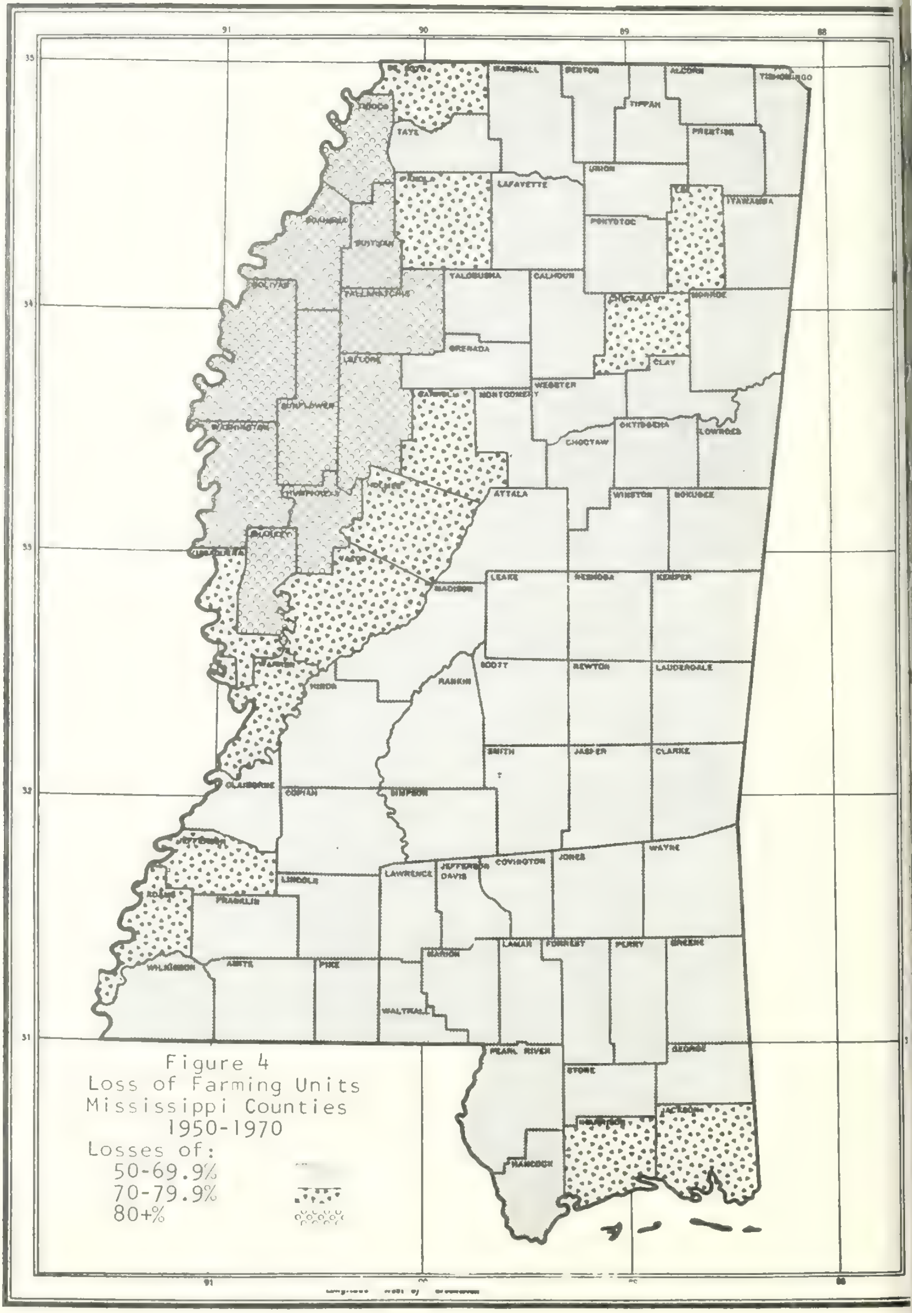
Figure 3
Urban Population Change
Mississippi Counties
1950-1970
Average Gain = 62.6%
Above Average Gain ⁘
Below Average Gain ○○
Loss ░
No Urban Pop. 1950 ***
No Urban Pop. 1970 0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TALLAHATCHIE
YALOBUSHA
CALHOUN
CHICKASAW
MONROE
GRENADA
LEFLORE
CLAY
WEBSTER
CARROLL
MONTGOMERY
SUNFLOWER
WASHINGTON
OKTIBBEHA
LOWNDES
CHOCTAW
HUMPHREYS
HOLMES
ATTALA
WINSTON
NOXUBEE
SHARKEY
ISSAQUENA
YAZOO
LEAKE
NESHOBA
KEMPER
MADISON
WARREN
SCOTT
NEWTON
LAUDERDALE
RANKIN
HINDS
SMITH
JASPER
CLARKE
CLAIBORNE
COPIAH
SIMPSON
JEFFERSON
WAYNE
JEFFERSON DAVIS
COVINGTON
JONES
LINCOLN
LAWRENCE
ADAMS
FRANKLIN
LAMAR
FORREST
PERRY
GREENE
WILKINSON
AMITE
PIKE
MARION
WALTHALL
PEARL RIVER
GEORGE
STONE
HARRISON
JACKSON
HANCOCK
Losses of:
50-69.9%
70-79.9%
80+%

Figure 4
Loss of Farming Units
Mississippi Counties
1950-1970

County	1970 Population				Percent Change 1950-1970			
	Total	Urban	Rural		Total	Urban	Rural	
			Nonfarm	Farm			Nonfarm	Farm
State								
Total	2,216,912	987,312	1,019,277	210,323	+1.74	+62.61	+114.79	-80.83
White	1,394,921	653,482	621,471	119,968	+17.36	+74.58	+99.12	-76.11
Nonwhite	821,991	333,830	397,806	90,355	-16.99	+43.37	+144.90	-84.82
Adams								
Total	37,293	19,704	17,277	312	+15.62	-13.35	+252.45	-93.24
White	19,414	9,745	9,553	116	+20.19	-23.76	+270.27	-85.34
Nonwhite	17,879	9,959	7,724	196	+11.03	+0.01	+232.64	-94.87
Alcorn								
Total	27,179	11,572	12,651	2,956	+0.08	+18.26	+161.87	-76.43
White	23,940	9,287	11,855	2,798	+2.95	+23.28	+169.31	-75.28
Nonwhite	3,239	2,285	796	158	-17.03	+1.47	+85.55	-87.08
Amite								
Total	13,763	—	10,945	2,818	-28.55	—	+95.10	-79.36
White	6,821	—	5,336	1,485	-22.69	—	+64.84	-73.42
Nonwhite	6.942	—	5,609	1,333	-33.49	—	+136.37	-83.47
Attala								
Total	19,570	7,266	9,108	3,196	-26.57	+7.60	+151.53	-80.37
White	11,574	4,529	5,180	1,865	-23.27	+12.10	+78.50	-77.09
Nonwhite	7,996	2,737	3,928	1,331	-30.88	+0.88	+446.31	-83.64
Benton								
Total	7,505	—	5,638	1,867	-14.65	—	+432.89	-75.86
White	4,356	—	3,355	1,001	-11.88	—	+252.42	-74.92
Nonwhite	3,149	—	2,283	866	-18.21	—	+2053.77	-76.87

(TABLE 5 continued)

County	1970 Population				Percent Change 1950-1970			
	Total	Urban	Rural		Total	Urban	Rural	
			Nonfarm	Farm			Nonfarm	Farm
Bolivar								
Total	49,409	20,786	25,534	3,089	-21.58	+208.08	+57.63	-92.29
white	19,004	10,682	6,749	1,573	-4.35	+157.21	+11.54	-83.72
Nonwhite	30,405	10,104	18,785	1,516	-29.51	+289.51	+85.11	-95.01
Calhoun								
Total	14,623	—	11,219	3,404	-20.39	—	+102.33	-73.46
White	10,810	—	8,239	2,571	-23.22	—	+83.74	-73.21
Nonwhite	3,813	—	2,980	833	-11.10	—	+180.87	-74.20
Carroll								
Total	9,397	—	7,399	1,998	-39.37	—	+153.65	-84.12
White	4,621	—	3,674	947	-30.65	—	+99.35	-80.35
Nonwhite	4,776	—	3,725	1,051	-45.95	—	+246.83	-86.46
Chickasaw								
Total	16,805	5,722	8,874	2,209	-11.32	—	+33.20	-82.02
White	10,825	3,949	5,279	1,607	+2.85	—	+12.59	-72.51
Nonwhite	5,980	1,773	3,605	602	-29.03	—	+81.89	-90.66
Choctaw								
Total	8,440	—	6,980	1,460	-23.34	—	+107.74	-80.91
White	6,074	—	4,971	1,103	-20.91	—	+123.52	-79.78
Nonwhite	2,366	—	2,009	357	-28.93	—	+76.85	-83.72
Claiborne								
Total	10.086	2,649	6,069	1,368	-15.56	-9.28	+91.45	-76.63
White	2,564	946	1,073	545	-14.82	-9.21	+74.47	-59.72
Nonwhite	7,522	1,703	4,996	823	-15.80	-9.32	+95.54	-81.72
Clarke								

County	1970 Population				Percent Change 1950-1970			
	Total	Urban	Rural		Total	Urban	Rural	
			Nonfarm	Farm			Nonfarm	Farm
White	9,634	1,902	6,557	1,175	-16.07	—	+17.49	-80.08
Nonwhite	5,415	875	4,246	294	-31.31	—	+26.33	-93.50
Clay								
Total	18,840	8,513	8,250	2,077	+6.10	+32.35	+265.21	-77.09
White	9,528	5,028	3,347	1,153	+24.39	+40.68	+174.79	-59.80
Nonwhite	9,312	3,485	4,903	924	-7.77	+21.94	+370.99	-85.09
Coahoma								
Total	40,447	21,673	13,919	4,855	-18.06	+31.04	+200.56	-82.78
White	14,207	9,792	3,353	1,062	+3.69	+31.61	+61.82	-74.65
Nonwhite	26,240	11,881	10,566	3,793	-26.41	+30.57	+312.90	-84.20
Copiah								
Total	24,749	8,660	13,859	2,230	-18.84	+22.44	+70.78	-85.43
White	12,302	4,277	6,475	1,550	-13.43	+5.81	+62.40	-74.93
Nonwhite	12,447	4,383	7,384	680	-23.56	+44.61	+78.88	-92.55
Covington								
Total	14,002	—	11,467	2,535	-12.68	—	+145.13	-77.69
White	9,437	—	7,500	1,937	-12.81	—	+114.10	-73.54
Nonwhite	4,565	—	3,967	598	-12.43	—	+237.62	-85.19
DeSoto								
Total	35,885	8,931	23,062	3,892	-45.88	—	+398.96	-80.52
White	23,261	8,922	12,976	1,363	+187.99	—	+314.70	-72.45
Nonwhite	12,624	9	10,086	2,529	-23.59	—	+575.55	-83.17
Forrest								
Total	57,849	44,952	12,067	830	+28.39	+52.51	+19.85	-84.95
White	43,537	33,597	9,171	769	+ 35.67	+72.32	+ 15.29	-83.42

(TABLE 5 continued)

County	1970 Population				Percent Change 1950-1970			
	Total	Urban	Rural		Total	Urban	Rural	
			Nonfarm	Farm			Nonfarm	Farm
Nonwhite	14,312	11,355	2,896	61	+ 10.39	+13.81	+ 37.06	-93.04
Franklin								
Total	8,011	—	7,396	615	- 26.70	—	+ 21.41	-87.29
White	4,897	—	4,425	472	- 26.08	—	+ 37.59	-86.16
Nonwhite	3,114	—	2,971	143	- 27.65	—	+ 3.30	-89.99
George								
Total	12,459	—	11,432	1,027	+ 24.44	—	+118.96	-78.56
White	10,997	—	10,000	997	+ 25.24	—	+134.08	-77.89
Nonwhite	1,462	—	1,432	30	+18.77	—	+ 50.90	-89.36
Greene								
Total	8,545	—	7,423	1,122	+ 4.02	—	+ 84.47	-73.23
White	6,652	—	5,647	1,005	- .88	—	+94.05	-73.56
Nonwhite	1,893	—	1,776	117	+ 25.86	—	+ 59.43	-70.00
Grenada								
Total	19,854	9,944	8,905	1,005	+ 5.44	+34.60	+127.69	-86.66
White	11,164	5,606	5,013	545	+ 24.03	+40.64	+ 99.32	-78.20
Nonwhite	8,690	4,338	3,892	460	- 11.59	+27.51	+178.80	-90.86
Hancock								
Total	17,387	10,041	6,911	435	+ 46.22	+117.29	+ 44.13	-82.42
White	14,898	8,306	6,157	435	+51.22	+130.08	+60.01	-81.83
Nonwhite	2,489	1,735	754	—	+ 22.07	+71.61	- 20.38	-100.00
Harrison								
Total	134,582	111,985	22,078	519	+ 60.08	+60.97	+117.22	-88.04
White	111,346	89,944	20,910	492	+ 57.59	+54.16	+152.20	97.75

County	1970 Population				Percent Change 1950-1970			
	Total	Urban	Rural		Total	Urban	Rural	
			Nonfarm	Farm			Nonfarm	Farm
Hinds								
Total	214,973	180,462	30,625	3,886	+ 51.21	+79.99	+56.11	-82.56
White	130,804	113,967	15,297	1,540	+ 67.17	+90.04	+ 14.00	-68.29
Nonwhite	84,169	66,495	15,328	2,346	+ 31.68	+65.04	+147.27	-86.54
Holmes								
Total	23,120	5,502	13,941	3,677	- 30.57	+72.05	+69.00	-83.18
White	7,337	2,762	3,662	913	- 16.85	+99.86	- 8.29	-73.53
Nonwhite	15,783	2,740	10,279	2,764	- 35.52	+50.88	+141.52	-84.98
Humphreys								
Total	14,601	3,098	8,253	3,250	- 36.83	-23.90	+219.69	-80.26
White	5,127	1,207	2,740	1,180	- 26.89	-22.33	+112.90	-71.72
Nonwhite	9,474	1,891	5,513	2,070	- 41.16	-24.87	+325.71	-83.16
Issaquena								
Total	2,737	—	2,038	699	- 4489	—	+291.92	-84.28
White	1,039	1,039	—	622	417	-35.75	—	+169.68
Nonwhite	1,698	—	1,416	282	- 49.30	—	+396.84	-90.80
Itawamba								
Total	16,847	2,899	11,621	2,327	- 2.14	—	+168.57	-81.95
White	15,928	2,617	11,083	2,228	- 2.16	—	+172.91	-81.77
Nonwhite	919	282	538	99	- 1.92	—	+102.26	-85.25
Jackson								
Total	87,975	63,028	24,500	447	+180.17	+257.20	+130.48	-85.70
White	73,638	50,121	23,093	424	+198.56	+282.17	+169.90	-85.83
Nonwhite	14,337	12,907	1,407	23	+112.81	+184.92	- 32.16	-82.71
Jasper								
Total	15,994	—	13,836	2,158	- 15.43	—	-163.14	-84.20

(TABLE 5 continued)

County	1970 Population				Percent Change 1950-1970			
	Total	Urban	Rural		Total	Urban	Rural	
			Nonfarm	Farm			Nonfarm	Farm
White	8,571	—	6,997	1,574	- 6.77	—	+160.40	-75.81
Nonwhite	7,423	—	6,839	584	- 23.62	—	+166.01	-91.83
Jefferson								
Total	9,295	—	7,468	1,827	- 17.79	—	+107.21	-76.28
White	2,299	—	1,526	773	- 20.37	—	+ 23.06	-53.07
Nonwhite	6,996	—	5,942	1,054	- 16.90	—	+151.35	-82.60
Jeff Davis								
Total	12,936	—	10,234	2,702	- 16.54	—	+236.31	-78.31
White	6,439	—	4,877	1,562	-6.55	—	+143.36	-68.03
Nonwhite	6,497	—	5,357	1,140	- 24.54	—	+415.59	-84.94
Jones								
Total	56,357	28,788	24,404	3,165	- 1.53	+ 0.60	+106.60	-81.17
White	42,423	18,735	21,002	2,686	+ .51	+ 1.20	+102.51	-79.84
Nonwhite	13,934	10,053	3,402	479	-7.28	-0.50	+136.09	-86.25
Kemper								
Total	10,233	—	6,757	3,476	- 35.61	—	+117.83	-72.82
White	4,437	—	3,115	1,322	- 31.32	—	+ 72.77	-71.61
Nonwhite	5,796	—	3,642	2,154	- 38.56	—	+180.37	-73.52
Lafayette								
Total	24,181	13,915	8,499	1,767	+ 6.07	+251.74	+ 31.02	-85.70
White	17,339	11,371	4,880	1,088	+ 17.88	+279.54	- 8.55	-82.94
Nonwhite	6,842	2,544	3,619	679	- 15.42	+165.00	+214.42	-88.64
Lamar								
Total	15,209	313	13,697	1,199	+ 15.00	—	+120.67	-82.92
White	13,196	313	11,706	1,177	+ 18.68	[illegible]	[illegible]	[illegible]

County	1970 Population				Percent Change 1950-1970			
	Total	Urban	Rural		Total	Urban	Rural	
			Nonfarm	Farm			Nonfarm	Farm
Lauderdale								
Total	67,087	45,083	20,628	1,376	+ 4.54	+ 7.61	+111.90	-89.03
White	46,281	29,920	15,392	969	+ 13.45	+ 9.44	+129.01	-85.61
Nonwhite	20,806	15,163	5,236	407	- 10.99	+ 4.18	+ 73.72	-92.99
Lawrence								
Total	11,137	—	9,921	1,216	- 11.88	—	+164.00	-86.31
White	7,553	—	6,579	974	- 4.16	—	+154.02	-81.59
Nonwhite	3,584	—	3,342	242	- 24.67	—	+186.13	-93.26
Leake								
Total	17,085	3,031	10,050	4,004	- 20.94	—	+144.52	-77.12
White	10,376	2,351	5,588	2,437	- 16.63	—	+ 89.75	-74.35
Nonwhite	6,709	680	4,462	1,567	- 26.79	—	+283.00	-80.41
Lee								
Total	46,148	20,471	22,624	3,053	+ 20.69	+ 77.59	+204.74	-84.17
White	36,586	16,892	17,370	2,324	+ 32.66	+108.13	+176.95	-82.38
Nonwhite	9,562	3,579	5,254	729	-10.29	+4.93	+356.08	-88.04
Leflore								
Total	42,111	22,400	15,671	4,040	- 18.73	+ 24.02	+198.84	-85.83
White	17,602	11,147	5,474	981	+ 6.80	+ 24.53	+ 72.14	-77.45
Nonwhite	24,509	11,253	10,197	3,059	- 30.63	+ 23.52	+394.04	-87.34
Lincoln								
Total	26,198	10,700	12,556	2,942	- 6.10	+ 37.16	+ 68.54	-76.74
White	18,134	6,659	9,149	2,326	- 3.10	+ 39.13	+ 93.34	-74.71
Nonwhite	8,064	4,041	3,407	616	- 12.20	+ 34.03	+ 25.35	-82.16
Lowndes								
Total	49,700	29,951	16,988	2,761	+ 31.30	+ 74.42	+128.43	-79.15

(TABLE 5 continued)

County	1970 Population				Percent Change 1950-1970			
	Total	Urban	Rural		Total	Urban	Rural	
			Nonfarm	Farm			Nonfarm	Farm
White	33,398	19,895	11,858	1,645	+71.78	+116.30	+137.83	-68.72
Nonwhite	16,302	10,056	5,130	1,116	-11.45	+26.11	+109.30	-86.02
Madison								
Total	29,737	10,503	15,913	3,321	- 12.18	+49.02	+171.46	-84.15
White	11,175	4,557	5,600	1,018	+ 25.20	+71.83	+ 89.51	-69.33
Nonwhite	18,562	5,946	10,313	2,303	- 25.56	+35.26	+ 54.76	-86.94
Marion								
Total	22,871	7,495	13,077	2,299	- 4.57	+22.39	+160.86	-82.08
White	15,732	5,345	8,612	1,775	+1.01	+29.14	+155.39	-77.99
Nonwhite	7,139	2,150	4,465	524	- 14.93	+ 8.31	+172.09	-89.01
Marshall								
Total	24,027	5,728	14,213	4,086	- 4.30	+74.85	+432.72	-78.68
White	9,124	2,331	5,805	988	+23.73	+66.98	+233.24	-76.68
Nonwhite	14,903	3,397	8,408	3,098	- 15.95	+80.69	+807.99	-79.24
Monroe								
Total	34,043	13,398	16,996	3,649	- 6.84	+30.33	+135.86	-80.85
White	23,655	9,122	12,252	2,281	+ 3.62	+42.07	+102.38	-77.97
Nonwhite	10,388	4,276	4,744	1,368	- 24.25	+10.81	+311.81	-84.28
Montgomery								
Total	12,918	5,489	5,688	1,741	- 10.73	+59.52	+ 90.81	-78.37
White	7,126	3,341	2,814	971	- 13.58	+70.90	+ 39.24	-77.26
Nonwhite	5,792	2,148	2,874	770	- 6.94	+44.55	+199.38	-79.62
Neshoba								
Total	20,802	6,358	10,534	3,910	-19.15	+42.17	+195.65	-77.90

County	1970 Population				Percent Change 1950-1970			
	Total	Urban	Rural		Total	Urban	Rural	
			Nonfarm	Farm			Nonfarm	Farm
Nonwhite	5,399	1,983	2,463	953	- 19.01	+46.35	+280.68	-79.57
Newton								
Total	18,983	3,556	12,850	2,577	- 16.30	+22.12	+136.87	-82.03
White	13,353	2,257	8,790	2,306	- 9.95	+10.96	+139.51	-74.73
Nonwhite	5,630	1,299	4,060	271	- 28.30	+47.95	+131.34	-94.81
Noxubee								
Total	14,288	2,877	7,745	3,666	- 28.64	—	+ 57.80	-75.74
White	4,844	1,503	2,109	1,232	- 5.34	—	- 11.16	-55.09
Nonwhite	9,444	1,374	5,636	2,434	- 36.64	—	+122.42	-80.32
Oktibbeha								
Total	28,752	16,072	10,890	1,790	+ 17.03	+126.14	+ 57.78	-83.05
White	18,555	12,607	4,852	1,096	+ 44.76	+158.50	+ 3.94	-66.51
Nonwhite	10,197	3,465	6,038	694	- 13.22	+55.38	+170.28	-90.48
Panola								
Total	26,829	3,796	18,495	4,538	- 14.20	—	+ 93.81	-79.12
White	13,061	3,107	7,724	2,230	- 5.23	—	+ 28.16	-71.24
Nonwhite	13,768	689	10,771	2,308	- 21.28	—	+206.34	-83.48
Pearl River								
Total	27,802	10,450	16,243	1,109	+ 34.69	+55.81	+186.32	-86.58
White	22,664	6,914	14,686	1,064	+ 40.35	+79.58	+208.66	-85.89
Nonwhite	5,138	3,536	1,577	45	+ 14.36	+23.77	+ 70.16	-93.76
Perry								
Total	9,065	—	7,945	1,120	- 0.47	—	+ 82.90	-76.49
White	6,674	—	5,751	923	- 3.23	—	+ 88.68	-76.02
Nonwhite	2,391	—	2,194	197	+ 8.14	—	+ 69.29	-78.47
Pike								

(TABLE 5 continued)

County	1970 Population				Percent Change 1950-1970			
	Total	Urban	Rural		Total	Urban	Rural	
			Nonfarm	Farm			Nonfarm	Farm
Total	31,756	11,833	17,990	1,933	- 9.62	+13.77	+ 44.77	-84.30
White	17,922	7,914	8,816	1,192	- 7.75	+ 1.10	+ 37.66	-77.06
Nonwhite	13,834	3,919	9,174	741	- 11.94	+52.31	+ 52.32	-89.58
Pontotoc								
Total	17,363	3,451	10,255	3,657	- 13.16	—	+116.40	-76.03
White	14,225	2,884	8,141	3,200	- 12.07	—	+103.37	-73.72
Nonwhite	3,138	567	2,114	457	- 17.77	—	+187.23	-85.16
Prentiss								
Total	20,133	5,895	11,216	3,022	+ 1.63	+73.91	+232.23	-77.00
White	17,828	4,992	9,891	2,945	+ 2.01	+82.19	+230.25	-74.92
Nonwhite	2,305	903	1,325	77	- 1.20	+62.70	+247.77	-94.49
Quitman								
Total	15,888	2,609	8,990	4,289	- 38.62	—	+ 71.27	-79.22
White	6,730	1,080	3,877	1,773	- 33.91	—	+ 37.73	-75.94
Nonwhite	9,158	1,529	5,113	2,516	- 41.68	—	+110.07	-81.04
Rankin								
Total	43,933	12,218	29,092	2,623	+ 52.12	—	+ 88.55	-80.50
White	31,484	11,562	18,388	1,534	+107.00	—	+ 96.43	-73.77
Nonwhite	12,449	656	10,704	1,089	- 8.94	—	+ 76.40	-85.68
Scott								
Total	21,369	6,715	11,878	2,776	- 1.44	+133.65	+116.59	-79.16
White	14,304	4,585	7,787	1,932	+ 16.20	+200.07	+126.70	-73.70
Nonwhite	7,065	2,130	4,091	844	- 24.61	+58.25	+ 99.66	-85.88
Sharkey								

County	1970 Population				Percent Change 1950-1970			
	Total	Urban	Rural		Total	Urban	Rural	
			Nonfarm	Farm			Nonfarm	Farm
White	3,142	—	2,488	654	- 15.24	—	+ 48.71	-67.85
Nonwhite	5,795	—	2,920	2,875	- 36.98	—	+ 63.86	-61.22
Simpson								
Total	19,947	2,911	14,687	2,349	- 8.58	—	+ 56.53	-83.37
White	13,658	2,311	9,714	1,633	- 6.12	—	+ 48.71	-81.49
Nonwhite	6,289	600	4,973	716	- 13.49	—	+ 63.86	-86.50
Smith								
Total	13,561	—	10,254	3,307	- 18.99	—	+ 90.86	-75.40
White	10,620	—	7,673	2,947	- 20.45	—	+ 69.59	-71.90
Nonwhite	2,941	—	2,581	360	- 13.24	—	+152.82	-87.83
Stone								
Total	8,101	2,932	4,628	541	+ 29.33	—	+211.01	-79.77
White	6,226	2,173	3,572	481	+ 27.09	—	+167.91	-78.23
Nonwhite	1,875	759	1,056	60	+ 37.36	—	+496.07	-87.10
Sunflower								
Total	37,047	11,615	19,296	6,136	- 33.88	+165.85	+ 28.91	-84.31
White	13,619	5,276	6,153	2,190	- 23.80	+152.08	+ 32.79	-77.64
Nonwhite	23,428	6,339	13,143	3,946	- 38.60	+178.51	+ 17.33	-86.54
Tallahatchie								
Total	19,338	2,627	7,856	8,855	- 36.57	- 0.08	+ 53.64	-62.09
White	7,650	1,254	3,842	2,544	- 30.94	- 16.73	+ 2.82	-63.10
Nonwhite	11,688	1,373	4,014	6,301	- 39.78	+ 22.26	+ 99.89	-61.67
Tate								
Total	18,544	4,247	11,260	3,037	+ 2.96	—	+ 74.66	-77.92
White	9,780	3.065	5,189	1,526	+ 28.01	—	+ 44.98	-69.18
Nonwhite	8,764	1,182	6,071	1,511	- 15.50	—	+117.21	-82.83

(TABLE 5 continued)

County	1970 Population				Percent Change 1950-1970			
	Total	Urban	Rural		Total	Urban	Rural	
			Nonfarm	Farm			Nonfarm	Farm
Tippah								
Total	15,852	3,482	9,277	3,093	- 9.53	—	+ 71.54	-74.47
White	13,246	2,845	7,851	2,550	- 6.25	—	+ 72.25	-73.36
Nonwhite	2,606	637	1,426	543	- 23.20	—	+ 67.76	-78.65
Tishomingo								
Total	14,940	—	12,922	2,018	- 3.89	—	+125.71	-79.45
White	14,271	—	12,319	1,952	- 3.17	—	+129.66	-79.18
Nonwhite	669	—	603	66	- 17.00	—	+ 67.04	-85.17
Tunica								
Total	11,854	—	5,979	5,875	- 45.28	—	+ 92.00	-68.33
White	3,240	—	2,208	1,032	- 17.75	—	+ 39.57	-56.22
Nonwhite	8,614	—	3,771	4,843	- 51.40	—	+146.15	-70.09
Union								
Total	19,096	6,426	9,457	3,213	- 5.76	+74.62	+186.75	-75.81
White	16,146	4,877	8,534	2,735	- 2.89	+84.04	+199.54	-75.42
Nonwhite	2,950	1,549	923	478	- 18.87	+50.39	+105.57	-77.84
Walthall								
Total	12,500	—	9,620	2,880	- 19.68	—	+272.44	-77.81
White	7,406	—	5,645	1,761	- 11.80	—	+235.41	-73.77
Nonwhite	5,094	—	3,975	1,119	- 28.90	—	+341.67	-82.14
Warren								
Total	44,981	25,586	18,372	1,023	+ 13.54	- 8.45	+207.89	-82.06
White	26,497	12,913	13,049	535	+ 35.72	- 9.48	+299.91	-73.20
Nonwhite	18,484	12,673	5,323	488	- 8.00	- 7.38	+ 96.86	-86.83
Washington								

County	1970 Population				Percent Change 1950-1970			
	Total	Urban	Rural		Total	Urban	Rural	
			Nonfarm	Farm			Nonfarm	Farm
White	31,874	22,369	8,039	1,466	+ 36.00	+63.48	+ 97.37	-74.19
Nonwhite	38,707	26,529	10,659	1,519	- 17.76	+26.39	+179.91	-93.18
Wayne								
Total	16,650	4,368	10,562	1,720	- 2.12	+26.90	+195.69	-82.79
White	11,163	2,670	7,248	1,245	+ 3.44	+35.33	+229.60	-81.19
Nonwhite	5,487	1,698	3,314	475	- 11.76	+15.59	+141.37	-85.93
Webster								
Total	10,047	—	8,417	1,630	- 13.44	—	+160.19	-80.53
White	7,789	—	6,307	1,482	- 12.63	—	+148.11	-76.75
Nonwhite	2,258	—	2,110	148	- 16.12	—	+204.47	-92.60
Wilkinson								
Total	11,099	—	9,881	1,218	- 21.37	—	+ 40.36	-82.79
White	3,583	—	3,281	302	- 17.78	—	+ 15.73	-80.17
Nonwhite	7,516	—	6,600	916	- 22.98	—	+ 56.96	-83.50
Winston								
Total	18,406	6,568	8,498	3,340	- 17.21	+24.35	+192.73	-76.22
White	10,956	4,002	4,553	2,401	- 15.32	+35.43	+137.88	-70.24
Nonwhite	7,450	2,566	3,945	939	- 19.83	+10.27	+298.89	-84.29
Yalobusha								
Total	11,915	3,597	6,785	1,533	- 21.57	+11.95	+190.08	-84.10
White	7,101	2,455	3,925	721	- 16.74	- 0.37	+143.64	-83.81
Nonwhite	4,814	1,142	2,860	812	- 27.74	+52.47	+292.86	-84.34
Yazoo								
Total	27,304	10,796	13,833	2,675	- 23.54	+10.77	+159.04	-87.03
White	12,725	4,327	7,120	1,278	- 6.65	+ 2.32	+112.41	-78.88
Nonwhite	14,579	6,469	6,713	1,397	- 33.97	+17.26	+237.68	-90.42

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BULLETIN 810

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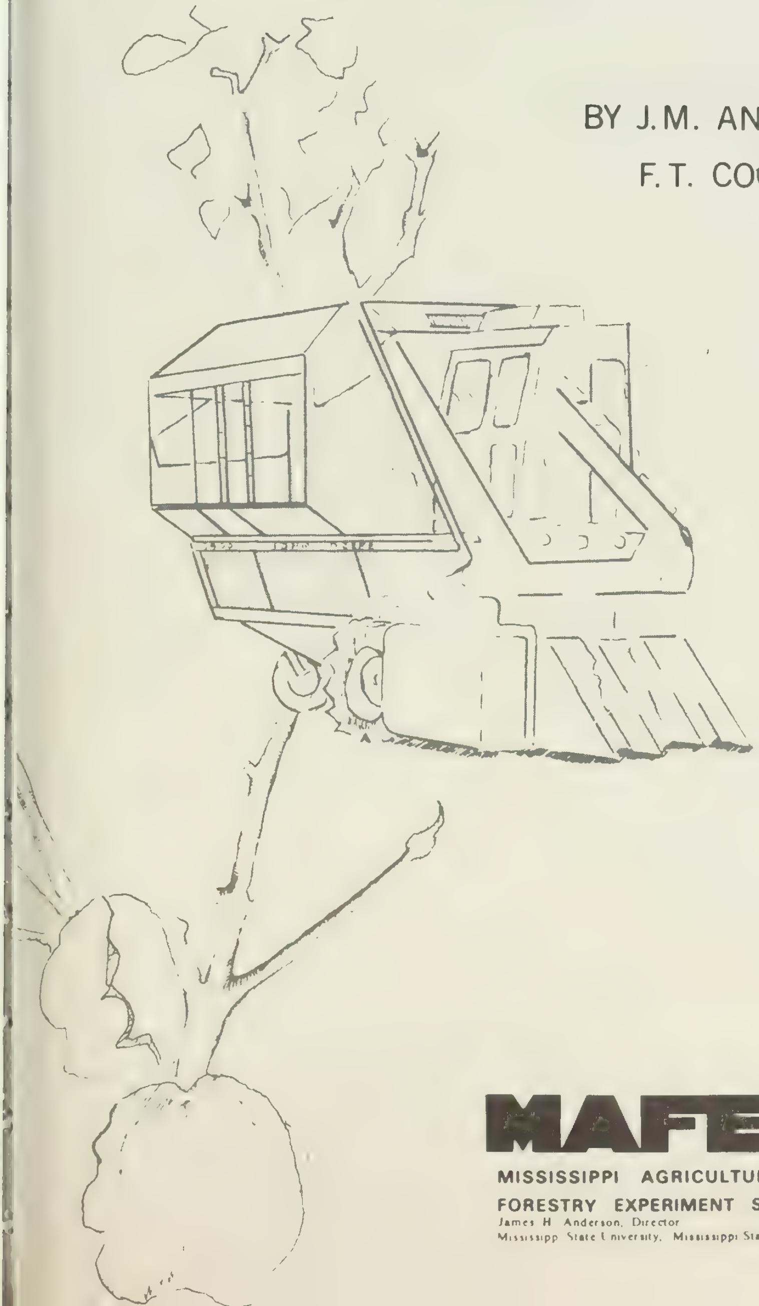

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Bulletin No. 810

CONVENTIONAL SYSTEMS OF HANDLING AND GINNING SEED COTTON IN THE DELTA AREA OF MISSISSIPPI

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ONVENTIONAL SYSTEMS OF HANDLING AND GINNING SEED COTTON IN THE DELTA AREA OF MISSISSIPPI

by: J. M. Anderson and F. T. Cooke, Jr

duction

uring the 1971 and 1972 cotton har-
ng seasons research was conducted
the following objectives:

) To estimate the inputs required for
ement of seed cotton from the
on plant to the gin in the Delta area
ississippi.

2) To determine the effects of seed
on hauling and/or storage capacity on
efficiency of spindle harvester opera-
in the Yazoo-Mississippi Delta.

3) To propose possible alternatives
increasing the efficiency of seed
on harvesting, handling, and ginning
is area of the Cotton Belt.

Sources

hrough the cooperation of many
on producers and ginners data were
ined from the following sources:

1) Farmer maintained records of har-
ng performance rates and cost of
ations.

2) Enumerator time and motion data
cted on selected farm and gin opera-
s.

3) Gin operator rates of efficiency
a limited number of gin sites.

wo articles and two papers regarding
lts obtained in this study have been
ared (1, 2, 3, 4).

lts—Farm Cooperators

summary of picking times as re-
ed by farm cooperators during the
first harvest of 1971 and 1972 is included in Table 1. Cooperators were not asked to record harvesting interruptions of less than one-half hour in length.

More total picking hours were available each day during 1972 due to the early maturing crop and favorable harvesting weather early in the season. Aside from the greater amount of time lost due to shortages of dump space during 1972, other delay factors were similar to those observed in 1971. Several producers reported shifting from first harvest to scrapping when dump space was extremely short.

Two of the fifteen cooperators utilized supplemental seed cotton storage space during 1972 (either a ricking device or a storage shed). Even with this amount of supplemental storage farmers still reported harvesters as being idle 4.8% of the time available picking time because of no dump space. The "estimated" column in Table 1 is based on the assumption that, without supplemental storage space, cotton harvesters would have been idle during periods when supplemental devices were utilized. In this case estimated harvester idle time due to no dump space increased to 12.0% of the available picking time. This appeared to be an upper limit on harverster down time during the harvest season with current ginning capacities and the harvest conditions experienced in 1972.

Field enumerators recorded detailed time and motion studies during both 1971 and 1972. Based on their observations, pickers were actively picking

Table 1. Farmer reported picking times, Delta area of Mississippi, first harvest, 197 1972.

Item	1971 Without supplemental seed cotton storage	1972 With supplemental seed cotton storage	Without supplement seed cotton storage[1]
Total hours reported	8,267	5,901	5,901
Net hours picked	7,243	4,962	4,540
Total downtime, hours			
Breakdown	423	316	316
No dump space	75	282	704
Weather	484	335	335
Miscellaneous	42	6	6
Total acres picked	9,511	6,311	5,750
Total bales picked	13,412	8,919	8,057
Total picker days	994	630	630
Gross hours per picker day	8.32	9.37	9.37
Net hours per picker day	7.29	7.88	7.21
Downtime per picker day, hours			
Breakdown	0.43	0.50	0.50
No dump space	0.08	0.45	1.12
Weather	0.49	0.53	0.53
Miscellaneous	0.04	0.01	0.01
Gross hours per acre picked	0.87	0.94	1.03
Net hours per acre picked	0.76	0.79	0.79
Gross hours per bale picked	0.62	0.66	0.73
Net hours per bale picked	0.54	0.56	0.56
Average yield per acre, bales	1.41	1.41	1.41

[1] Estimated.

cotton between 68% and 74% of the time (Table 2.) Substantially less harvester breakdown time was noted in 1972 than in 1971. Farmers reported about the same level of major breakdowns (Table 1) and minor interruptions observed by an enumerator were substantially less consuming in 1972. This may refl part, the excellent harvesting cond which prevailed prior to the last w October, 1972. It is possible that tional maintenance was performed periods when harvesters were idle due no dump space.

In 1972 dump times were recorded m field exit to reentry, less any delay ociated with other measured variables ble 3). Dump times were significantly ociated with trailer length and trailer th. For a given numbered dump of a en size increasing either the length, lth, or depth of the trailers resulted in dump time. Appendix 1 contains st squares regression equations for np times in both 1971 and 1972. De- ed data for 1971 are available in an lier publication (3).

ults—Mail Survey Respondents

A total of 50 cotton producers onded to a mail survey taken early in 1973 regarding their 1972 harvesting season. These producers provided the following average data (where appropriate, detailed data on a particular item have been included in the indicated appendix section):

(1) Field to gin distance, 4.46 miles
(2) Cotton per bale of trailer capacity, 10.1 acres
(3) Age of trailers, 8.3 years (Appendix 2)
(4) Initial cost of trailers, $794 per trailer (Appendix 2)
(5) 1972 trailer repair costs, $13.36 per trailer (Appendix 2)
(6) Capacity of seed cotton, 5.89 bales per trailer (Appendix 2)
(7) Trailer turnaround time, 34.5 hours
(8) Harvesters idle due to no dump

le 2. Enumerator reported proportional use of available time during cotton harvesting and handling activities, first harvest, Delta area of Mississippi, 1971 and 1972.

Activity	Proportion of observation period % 1971	1972
king	68.7	74.0
akdown	13.5	5.0
als	4.0	2.9
mp[1]	4.9	11.3
aning	3.9	2.6
ld service	1.6	1.6
dump space	1.3	0.9
or off picker	0.6	0.3
k cotton in harvester	0.2	0.5
cellaneous	1.3	0.9

[1] Dump time in 1971 was from the time from harvester stopped alongside the cotton trailer until basket dump was completed. Dump time was redefined in 1972 to include the period from field to field reentry by the harvester, less time devoted to other measured activities (e.g., cleaning).

Table 3. Enumerator reported dump times, trailer dimensions, size of dumps by nu of dump, Delta area of Mississippi, 1972.

Number of dump[1]	N	Observed means minutes/dump	Bales/dump	Trailer dimension, ft. width	length	dep
1	120	3.772	1.25	7.76	27.63	5.7
2	117	3.963	1.23	7.64	27.62	5.6
3	103	5.487	1.30	7.74	27.65	5.7
4	83	6.782	1.21	7.78	28.67	5.9
5	53	7.171	1.06	7.90	29.25	6.0
6	34	5.945	0.97	7.90	29.12	6.0
7	22	7.034	0.98	8.07	30.60	6.3
8	14	7.066	1.00	8.11	31.57	6.4
9	7	7.907	1.00	8.07	29.14	6.4

[1] A dump was redefined during the 1972 season. Enumerators recorded dump time in 19 the period of time from field exit to field reentry.

Table 4. Ginner reported ginning efficiencies reported by 7 gin setups, Delta area of Mississippi, 1972.

Gin number	Hours ginning reported	Ginning efficiencies: Total reporting period	Excluding breakdown time
		% of rated capacity	
1	489	49.8	51.6
2	257	61.5	69.9
3	521	56.0	67.3
4	296	64.2	74.1
5	179	57.3	65.7
6	439	102.3	106.3
7	241	64.3	84.8
Summary	2,421	59.0	65.6

le 5. Enumerator reported ginning efficiencies observed at 14 gin sites, Delta area of Mississippi, 1972.

in nber	Hours ginning observed	Total observation period	Ginning efficiencies: Excluding meal time	Ginning efficiencies: Excluding meal time and break-down time
		% of rated capacity	% of rated capacity	% of rated capacity
	16.6	109	109	112
	12.8	43	43	82
	46.9	56	60	63
	12.1	37	40	72
	18.1	44	46	49
	20.3	45	46	79
	44.4	91	93	113
	29.8	83	83	85
	25.1	71	71	81
	8.6	56	56	91
	16.4	75	75	108
	14.8	66	66	80
	34.3	84	84	95
	7.6	64	64	108
mary	307.8	66.9	68.3	83.4

space for seed cotton, 1.9 days

(9) Bales of seed cotton hauled per trailer, 75.4 with an estimated 84% of the crop harvested

(10) Average age of harvester, 4.83 years

(11) 1972 harvester repair costs, $1,169 per harvester (Appendix 3)

(12) Ten producers reported some supplemental seed cotton storage (Appendix 4)

sults—Gin Cooperators

Gin operators at seven sites maintained ning records over a substantial portion their 1972 ginning seasons (Table 4). A al of 2,421 hours of ginning was re- ted with an overall effective ginning efficiency of 59%. Breakdowns of one-half hour or more accounted for a reduction in ginning efficiency from 65.5% to 59.0%.

Results—Enumerator Data Collected in Gin Yards

Data were collected by enumerators at 14 different gin sites in 1972 (Table 5). Effective ginning efficiencies ranged from 37% to 109% of rated technical capacity as reported by gin operators. Comparison between gins was not possible due to many uncontrolled variables associated with each independent observation period. However, after 308 hours of direct observation these gins operated at about 67% of their rated capacity during 1972. Breakdown time contributed greatly to decreased gin efficiency.

A marked reduction in effective ginning capacity was noted when wet cotton was being ginned. Effective ginning capacities were reduced up to 50% when ginning occurred following periods of rainfall compared to ginning capacitites for dry cotton.

Costs

The costs associated with harvester to gin transfer of seed cotton are shown in Table 6 for both 1971 and 1972. Because of differences in farm units under consideration in the two years, comparisons between years must be made with care.

Although trailers hauled less seed cotton per unit of capacity in 1972 than in 1971 the cost per bale was less in 1972. This resulted primarily from the use of actual producer reported trailer repair costs in 1972 as compared to the estimated repair costs used in 1971. Apparently producers spend considerably less on trailer upkeep than had been previously thought.

Labor costs increased by $1.08 per bale in 1972. Increases in managerial labor accounted for $1.03 of this increase. Managers appeared to be more actively involved on their operations when the pace was hectic as it was during the early portion of the 1972 harvest season.

Total costs for harvesting, handling, and ginning ranged from $24.83 to $43.84 per bale harvested in 1972 (Table 7). The three most efficient farms had the following characteristics when compared to the two least efficient farms:

(1) Reported higher yields (0.30 bale more per acre).

(2) Harvested an additional 77 acres per harvesting unit.

(3) Harvested an additional 197 bales per harvesting unit.

(4) Utilized older harvesters (8 y vs. 4.5 years).

(5) Reported 5.3 fewer bales trailer capacity per acre cotton harvested.

Conclusions

The following conclusions were b on data collected during the 1971 1972 harvest seasons:

(1) Many farms experienced littl no delay in harvesting due to a lac dump space in 1971 and it is likely none will be experienced for future c with similar acreages and harvesting ginning conditions.

(2) Several farms experienced dela harvesting due to a lack of dump s with the harvesting conditions of 1 Contributing to the delays in 1972 increased acreages of cotton, h yields, and the early crop.

(3) Down times due to no dump s were quite variable from gin commu to gin community as a result of var total ginning capacities in a given graphic area.

(4) In areas where gin capacities hard pressed in 1972 producers were to substantially increase their field vesting efficiency by using supplem seed cotton storage. The investr depreciation, and estimated repair of ricker storage were $1.25 per more than trailer, investment, dep tion, and repair costs (no consider given to the differences in labor between the two systems). producers were able to harvest d better weather with less quality quantity losses than they would hav with cotton left on the stalk. Under conditions the added cost of su mental storage capability more than

for itself. No consideration was given to hauling seed cotton longer distances to less crowded gins.

(5) The focal point of need for seed cotton storage as an aid to increased harvesting and ginning efficiency appeared to be the gin rather than the harvester in the Delta area of Mississippi, especially, in view of current trends in health and labor regulations.

Recommendations

(1) Large producers (more than 2 harvesting units) in areas with known

le 6. Costs per bale for harvester to gin handling of seed cotton, Delta area of Mississippi, first harvests 1971 and 1972.

n	Amount	
	1971	1972
	- - - - Dollars- - -	
iler	1.40	1.22
ck	0.30	0.24
ctor	0.15	0.15
or[1]	1.54	2.62
al	3.39	4.23

Includes managerial labor and supervision.

le 7. Estimated costs per bale for harvesting, handling, and ginning seed cotton, 14 farm cooperators, Delta area of Mississippi, 1972.

rm ber	Equipment costs		Ginning[1]	Farm labor[2]	Total
	Harvesting	Hauling			
	- - - - - - - - - -	- - - - - - - - - -	Dollars per bale	- - - - - - - - - -	- - - - - - - - - -
	7.04	2.75	17.13	5.01	31.93
	8.06	2.67	17.13	4.85	32.71
	3.88	1.03	17.13	4.31	26.35
	10.64	1.65	17.13	3.88	33.30
	15.18	2.42	17.13	6.59	41.32
	6.66	1.11	17.13	4.84	29.74
	4.19	1.28	17.13	4.07	26.67
	1.68	2.09	17.13	3.93	24.83
	10.68	1.73	17.13	8.32	37.86
	9.33	1.16	17.13	5.06	32.68
	11.41	1.43	17.13	5.65	35.62
	6.65	1.13	17.13	3.40	28.31
	20.83	1.94	17.13	3.94	43.84
	12.67	0.71	17.13	5.60	36.11

---

[1] Source: U. S. Department of Agriculture, Economic Research Service, Marketing Economics ision and Agricultural Marketing Service, Cotton Division. "Charges for ginning cotton, costs of cted services incident to marketing, and related information, season 1971-72". Washington, D. May 1972.

[2] Includes managerial labor and supervision.

pressures against the available ginning capacities should consider the need for supplementing their seed cotton storage capabilities. The particular device used would be subject to individual needs and cost based on anticipated use (6). However, seed cotton storage at this time must be done with the questions of seed germination and oil seed quality still not fully resolved (5, 7, 8, 9).

(2) Analyses of the benefits accruable from modifying seed cotton handling systems should integrate current systems with gradual movement toward totally new systems occurring as current sunken capital is depleted (10). The cost inherent with immediate, complete shifts in investment capital used should be carefully considered.

(3) Future legal changes appear likely to affect both field to gin transportation and ginning operations more than farm operations and may make some of seed cotton storage advisable, if necessary.

(4) Any complete analysis of large-scale ginning systems with stantial seed cotton storage cap should consider the effect on cost varying quantities of cotton availabl ginning in a given season.

(5) The research effort should be tinued to evaluate the impact of various alternative handling system current harvesting, handling, and gir efficiencies given various level adoption of the new technologies. M need to be structured to permit c evaluation of the impact of discrete l legislative and technical change various components of the cotton vesting, handling, and ginning com

erature Cited

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APPENDIX 1

1971 Cotton Harvesting Season

Multiple regression techniques were utilized to estimate the effect on dump time of trailer size, number of bales per dump, first or second harvest, and the number of the dump. Dump time in 1971 was from the time the harvester stopped alongside the cotton trailer until the basket dump was completed. The number of dumps and first or second harvests were entered as dummy variables.

The following estimating equations permit an evaluation of the effects of the variables included on the time required to accomplish the dumping process during the 1971 harvest season:

Standard errors are shown in paren
sis below each regression coefficient.
efficients of determination (R^2) v
22% and 30% for Models 1 and 2, res
tively.

Intercept changes for second har
can be obtained by changing the res
tive $a_{1\text{-}9}$ value by -.360 for Model 1
-.096 for Model 2.

1972 Cotton Harvesting Season

Two least squares regression estima
equations were developed for estima

Model 1

$$\hat{Y}_{1\text{-}9} = a_{1\text{-}9} + \underset{(.364)}{0.497}\, X_1 + \underset{(1.353)}{3.517}\, X_2 - \underset{(.03060)}{0.05965}\, X_1^2 - \underset{(.4799)}{0.5828}\, X_2^2$$

Model 2

$$\hat{Y}_{1\text{-}9} = [a_{1\text{-}9} + \underset{(.084)}{.074}\, X_1 + \underset{(.313)}{0.95}\, X_2 - \underset{(.00707)}{0.01168}\, X_1^2 - \underset{(.1109)}{0.1369}\, X_2^2]^2$$

Where:

$\hat{Y}_{1\text{-}9}$ = estimated dump time for dumps 1-9, minutes

$a_{1\text{-}9}$ = adjusted intercept value for dumps 1-9, minutes

	Model 1	Model 2
a_1	= -2.765	+0.089
a_2	= -2.189	+0.305
a_3	= -0.944	+0.680
a_4	= +0.037	+0.918
a_5	= +1.213	+1.137

	Model 1	Model 2
a_6	= +1.456	+1.369
a_7	= +1.121	+1.309
a_8	= +2.259	+1.617
a_9	= +3.270	+1.913

X_1 = trailer capacity, bales of seed cotton

X_2 = amount of seed cotton dumped, bales of seed cotton

required for each numbered dump trailer width, length, and net depth ize of dump. Dump time was redefined in 1972 to include the period from field exit to field reentry by the harvester. The equations are:

odel 1

$$\hat{Y}_{1\text{-}9} = (13.92 + a_{1\text{-}9}) - \underset{(.250)}{0.1048\, X_1} - \underset{(.031)}{0.1832\, X_2} - \underset{(.172)}{0.3581\, X_3} + \underset{(.357)}{2.472\, X_4}$$

odel 2

$$\hat{Y}_{1\text{-}9} = [\, (4.198 + a_{1\text{-}9}) - \underset{(.046)}{0.0540\, X_1} - \underset{(.006)}{0.0363\, X_2} - \underset{(.032)}{0.0914\, X_3} + \underset{(.066)}{0.5236\, X_4}]^2$$

here:

$\hat{Y}_{1\text{-}9}$ = estimated dump time, minutes

$a_{1\text{-}9}$ = number of dump

X_1 = trailer width, feet

X_2 = trailer length, feet

X_3 = trailer bed net height, feet

X_4 = size of dump, bales

$a_{1\text{-}9}$ = values for each model are as follows:

mp	Model 1	Model 2
	-5.348	-1.098
	-5.098	-1.019
	-3.690	-0.712
	-1.940	-0.376

(continued on page 14)

Dump	Model 1	Mod
5	-1.039	-0.2
6	-2.050	-0.3
7	-0.574	-0.0
8	-0.385	-0.1
9	-0.000	-0.0

Expanded estimates for each dump and equation are included in Appendix Table 1. Model 1 and Model 2 equations accounted for 21% and 26% of the variation, respectively, in observed times. Standard errors are included each regression coefficient.

Appendix Table 1. Regression estimates for time required for harvester to transfer of seed cotton, Delta area of Mississippi, 1972.

Number of dump	Model 1[1]	Mod
	Minutes per dump	
1	3.427	3.12
2	3.677	3.41
3	5.085	4.63
4	6.835	6.19
5	7.736	6.97
6	6.725	6.24
7	8.201	8.08
8	8.390	9.18
9	8.775	8.21

---

[1] Models are specified in the text. Observed means were used for variables as follows: width, 7.76 ft.; trailer length, 28.27 ft.; net trailer depth, 5.85 ft.; bales per dump, 1.19.

APPENDIX 2

Cotton Trailer Data

itial investment costs, repair costs, r capacity, and age of trailers were ned from mail survey respondents 06 trailers. Least squares estimating tions were utilized to evaluate the in- ce of age on each of the other rs. These equations are as follows:

Standard errors for regression coefficients are included in parenthesis underneath each coefficient.

These equations have been evaluated for ages 0 through 12 years in Appendix Table 2 for initial investment cost per trailer, repair costs per trailer during 1972, and capacity of trailer.

$$(1)\quad \hat{Y}_1 = \underset{}{1088.59} - \underset{(23.11)}{124.47\,X_1} + \underset{(4.241)}{15.374\,X_1^2} - \underset{(0.2611)}{0.8256\,X_1^3} + \underset{(.00506)}{0.01514\,X_1^4}$$

$$R^2 = 21.9\%$$

$$(2)\quad \hat{Y}_2 = 6.65 + \underset{(2.18)}{4.72\,X_1} - \underset{(.400)}{0.617\,X_1^2} + \underset{(.0247)}{0.0292\,X_1^3} - \underset{(.00048)}{0.00048\,X_1^4}$$

$$R^2 = 2.4\%$$

$$(3)\quad \hat{Y}_3 = 7.40 - \underset{(.15)}{1.04\,X_1} + \underset{(.028)}{0.174\,X_1^2} - \underset{(.0017)}{0.0106\,X_1^3} + \underset{(.00003)}{0.00021\,X_1^4}$$

$$R^2 = 15.1\%$$

ere:

$\hat{Y}_1$ = estimated initial investment cost per trailer, dollars

$\hat{Y}_2$ = estimated repair costs per trailer, 1972, dollars

$\hat{Y}_3$ = estimated capacity per trailer, bales

X_1 = age of trailer, years

endix Table 2. Estimated initial investment cost, annual repair and maintenance costs, and trailer capacity, by age of trailer, mail survey respondents, Delta area of Mississippi, 1972.

of er	Initial investment cost per trailer	Annual repair and maintenance costs trailer	Trailer capacity
s	Dollars	Dollars	Bales
	1,088.59	6.65	7.40
	978.68	10.78	6.52

(continued on page 16)

Age of trailer	Initial investment cost per trailer	Annual repair and maintenance costs trailer	Traile capaci
2	894.78	13.85	5.94
3	832.48	16.01	5.58
4	787.73	17.40	5.40
5	756.85	18.18	5.36
6	736.52	18.44	5.41
7	723.79	18.32	5.51
8	716.06	17.91	5.65
9	711.11	17.29	5.78
10	707.07	16.55	5.90
11	702.44	15.75	5.98
12	696.07	14.95	6.01

Initial investment costs generally declined as the age of the trailers increased, but not in a linear fashion.

Mail survey respondents reported increased annual repair costs with increased age of trailers to about 6 years of age and then a slow decline beyond 6 years of age. The very low coefficient of determination (2.4%) indicates that repair and maintenance costs were only randomly associated with the age of trailer
1972.

Producers respondents to the ma
vey reported a decline in capaci
trailer age increased to 5 years fol
by gradual increases to 12-ye
trailers. Evaluation beyond 12 ye
age showed another period of dec
average trailer capacities for these
ducers.

APPENDIX 3

Harvester Repair Costs

The data obtained during the 1971
vesting study did not include any
rence to annual repair costs per har-
ting unit. Respondents to the mail
vey were asked to provide this infor-
tion for the calendar year 1972. These
ns reported average expenditures of
169 per harvesting unit during 1972.
general expression of the relationship
ween harvester repair costs in 1972
age of harvester for 112 harvesting
ts is included in the following equa-
n:

Results of expanding the above equation into estimates for 1972 repair costs for harvesters 0-10 years old are included in Appendix Table 3. Mail survey respondents reported that repair costs during 1972 increased fairly rapidly until harvester age reached 6 years and then began a gradual decline. Based on these data linear estimation of harvester repair costs as a constant percentage value of initial cost would tend to over estimate repair costs for newer harvesters and under estimate repair costs for older harvesters.

$$\hat{Y} = 107.45 + \underset{(341.30)}{693.70\, X_1} - \underset{(90.808)}{117.365\, X_1^2} + \underset{(8.4150)}{8.1228\, X_1^3} - \underset{(.24433)}{0.20533\, X_1^4}$$

$R^2 = 11.5\%$

Where

$\hat{Y}$ = estimated 1972 repair costs, dollars

X_1 = age of harvester, years

Harvester repair costs tended to be
large and were not repeated every
r. Therefore, repairs for harvesters 3
rs of age and older were generally
domly distributed and of about the
e magnitude regardless of harvester

Appendix Table 3.
Estimated annual harvester repair costs by age of harvester during calendar year 1972, mail survey respondents, Delta area of Mississippi.

Age of harvester	Annual repair costs per harvester
Years	Dollars
New	107.45
1	691.70
2	1,087.09
3	1,334.95
4	1,471.70
5	1,528.84
6	1,532.93
7	1,505.59
8	1,463.53
9	1,418.54
10	1,377.45

Appendix Table 4. Supplemental seed cotton storage, as reported by mail su respondents, Delta area of Mississippi, 1972.

Farm number	Type storage	Bales stored	Cost dollars per bale
1	Cotton module	128	1/
1	Borrowed trailer	144	1/
2	Open pen	30	5.00
3	Trailers	1/	1/
4	Cotton house at gin	65	4.00
5	Cotton house at gin	100	4.00
6	Trailers	75	1/
7	Implement shed	100	1/
8	Cotton house at gin	50	1/
9	Cotton ricker	50	3.00
10	Implement shed	240	1/

1/ Not reported.

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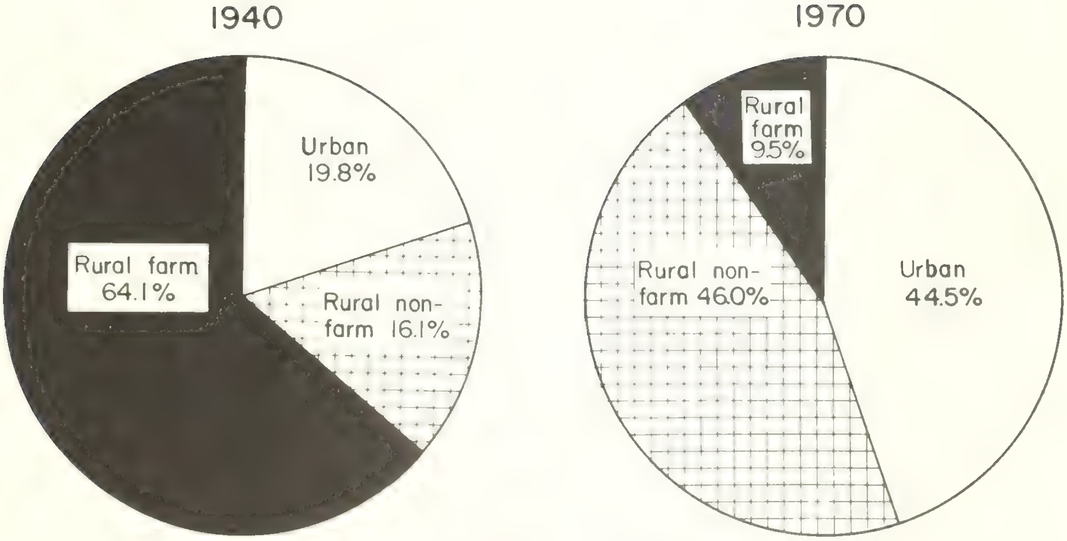
SOME ASPECTS OF POPULATION DYNAMICS IN MISSISSIPPI

by m.e. el attar



POPULATION CHANGES

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SOME ASPECTS OF POPULATION DYNAMICS IN MISSISSIPPI

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SOME ASPECTS OF POPULATION DYNAMICS IN MISSISSIPPI

"In the brief history of this nation," the Commission of Population Growth and the American future has commented, "we have always assumed that progress and 'the good life' are connected with population growth. In fact, population growth has frequently been regarded as a measure of our progress."[1] The Commission concluded that "our country can no longer afford the uncritical acceptance of the population growth ethic that 'more is better'" and "that no substantial benefits would result from continued growth of the nation's population." The Commission remarked that, "if this country is in crisis of spirit—environmental deterioration, racial antagonisms, the plight of the cities, the international situation—then population is a part of that crisis." These conclusions indicate the importance of the relation between "the good life" and the size, distribution, and composition of the population.

Census Data: Population Quality and Demographic Processes

In 1790, Thomas Jefferson handed George Washington the results of the first census of the United States of America. Every ten years since that date the decennial census—as provided by the Constitution—has been taken and has come to be an essential source of information about the people of this nation. The value of the census, however, does not reside primarily in the simple count of the number of people in a community or state. Instead, it is in the area of *population dynamics* that the census becomes a useful tool for the student of the *quality* of a population. Age and sex composition, education, marital status, employment, and population distribution are among the elements that characterize the *qualities* of a population; changes in these elements, in addition to demographic processes (births and deaths, migratory movements, marriages and divorces) identify the *dynamic qualities* of a population .

Population and Demographic Processes

There have been several changes in Mississippi's population since the 1940's (Table 1). The total population of Mississippi increased by 1.5 percent between 1940 and 1970. For the state as a whole, the three decades witnessed a population increase of 33,116 persons. On the other hand, the white population has been steadily growing since 1940, with its size increasing by nearly 26 percent (286,956) between 1940 and 1970. In contrast to the white population, the non-white population in the state declined by nearly 24 percent (253,840) from 1940 to 1970.

Three primary factors are involved in the process of population growth and change. These factors are births, deaths, and net migration. The latter refers to the number of people moving into a region minus the number of people moving out of that region.

In 1970, there were 48,141 live

Table 1. White and Non-white Population: Total and Percent Change, Mississippi, 1940 - 1970^a

Race	Population			
	1940	1950	1960	1970
White	1,106,327	1,188,632	1,257,407	1,393,283
Non-white	1,077,469	990,282	920,734	823,629
Total	2,183,796	2,178,914	2,178,141	2,216,912
	Percent Change			
	1940-50	1950-60	1960-70	1940-70
White	7.44	5.79	10.81	25.94
Non-white	-8.09	-7.02	-10.55	-23.56
Total	- .22	- .04	1.78	1.52

^{a}Source: U. S. Bureau of the Census, 1952, 1961a, and 1971.

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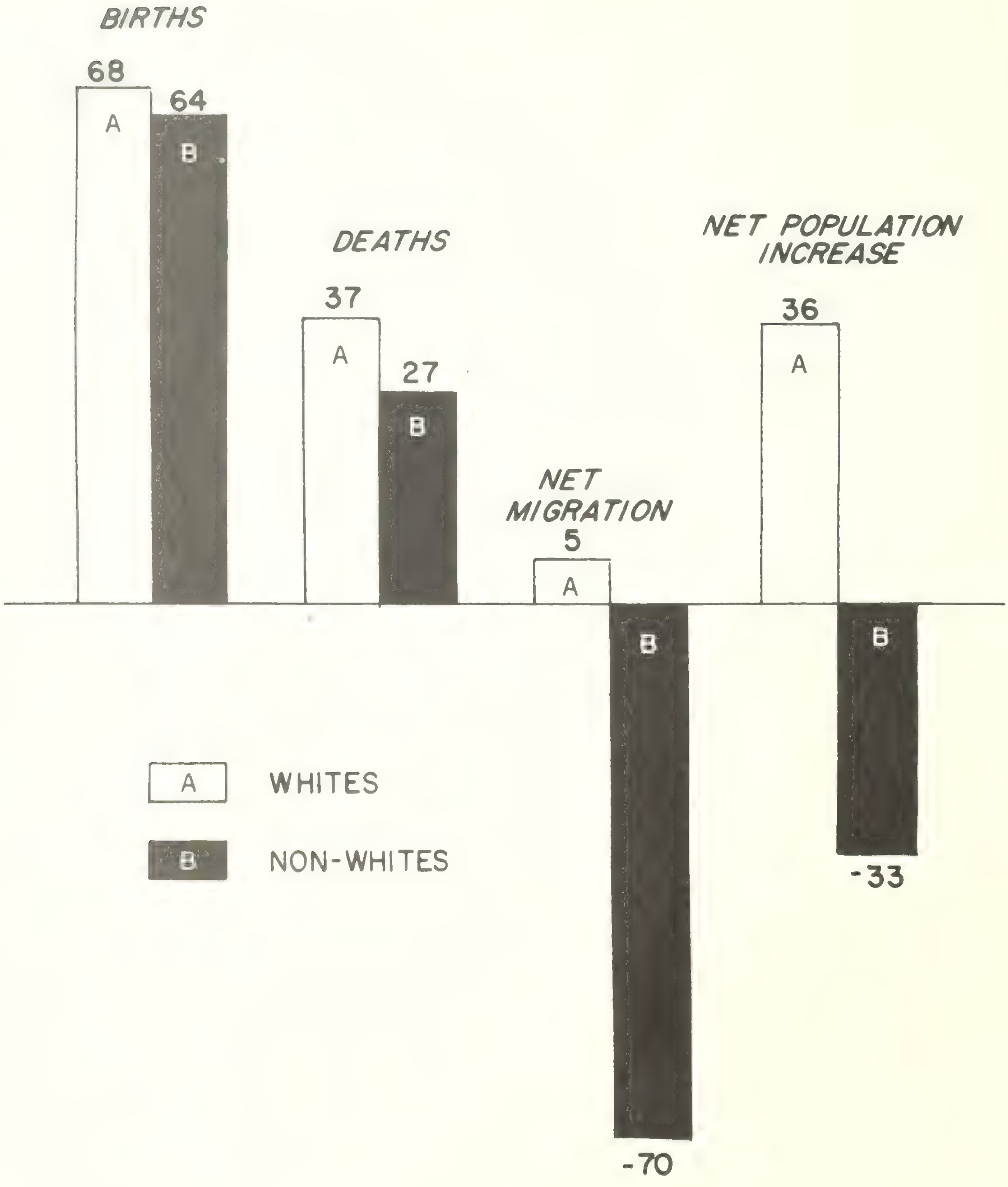
[1] *This was the opening statement in the first chapter of the Commission's report to President Nixon. The Commission was proposed by the President in 1969 to assess the probable impact of population growth and internal migration on the nation during the thirty years left in this century. See* **Commission on Population Growth** *cited at end of the article.*

Fig. 1. Diagram of estimated daily births, deaths, and net migration for whites and non-whites in Mississippi, 1970



births in Mississippi, a decrease of 8.7 percent over the number of live births in 1940 (52,732). Even though the birth rate (number of births per thousand population) in Mississippi was higher in 1940 (24.1 per thousand) than in 1970 (21.5 per thousand) it remained higher than that of the nation as a whole. The birth rates for the nation were 17.9 and 18.2 (provisional) in 1940 and 1970, respectively. However, the gap in the level of birth rate between Mississippi and the nation has narrowed. The birth rates among whites *dropped* from 21.1 in 1940 to 17.9 in 1970, while birth rates among non-whites *increased* from 27.3 in 1940 to 28.2 in 1970.

The number of deaths in 1940 (23,295) and 1970 (23,305) was about equal. Moreover, the gap in the level of the death rate (deaths per thousand population) between Mississippi and the nation has widened. Death rates in Mississippi were 10.7 per thousand in 1940 and 10.5 per thousand in 1970, while the death rate for the nation was 10.8 per thousand in 1940 and 9.4 per thousand in 1970.

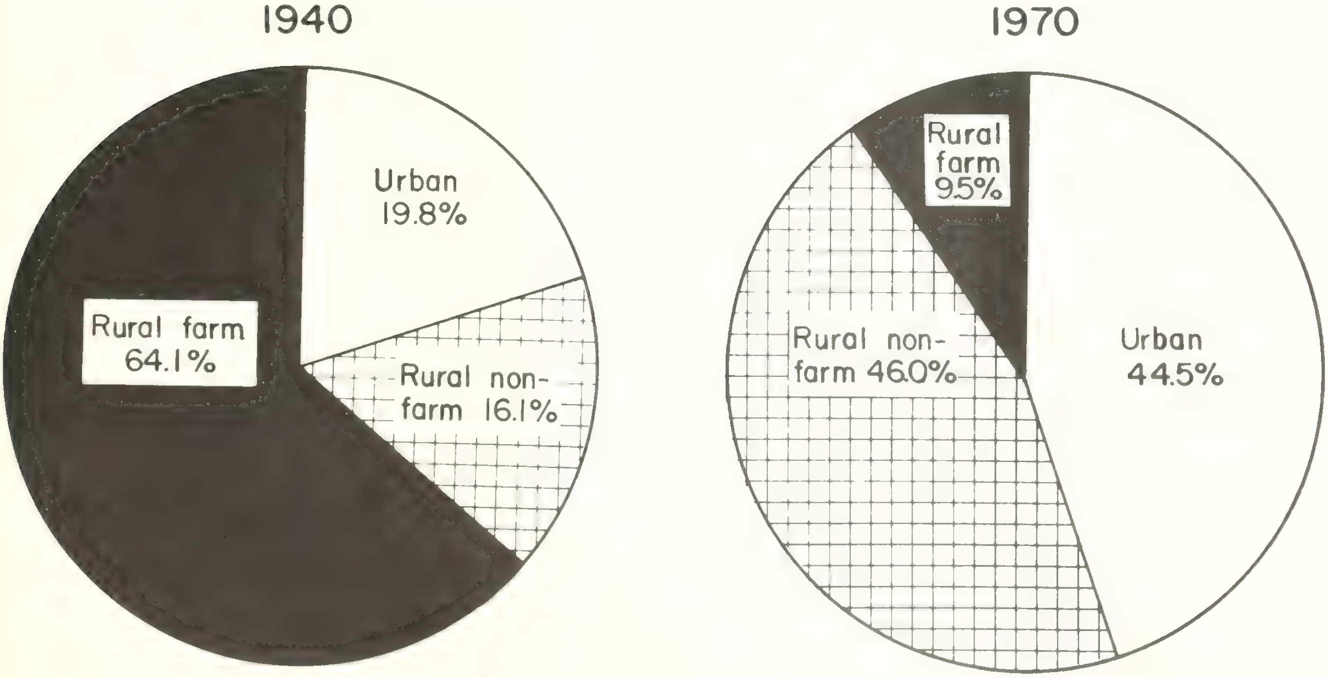
The state lost population between 1940 and 1970 as a result of more persons leaving the state (out-migration) than moved into it. The estimated losses are 435,000 from 1940-1950, 434,000 from 1950-1960 and 267,000 from 1960-1970.

Although these figures indicate considerable out-migration during the 30-year period, out-migration declined considerably during the last ten years and between 1960 and 1970 the white population of the state showed a net gain of about 10,000 due to migration.

Based solely on 1970 birth, death and yearly estimated net migration data, every day in Mississippi among whites an average of almost 68 babies are born, about 37 persons die, and an estimated five more persons move into the state than move out (Figure 1).

The total of these figures is an estimated increase in the white population of 36 persons per day in 1970, or slightly over 13,000 persons per year. Among non-whites, on the other hand, about 64 babies are born daily, about 27 persons die, and an estimated 70 more persons leave the state than enter. This indicates a net estimated loss

Fig. 2. Diagram of percent distribution of Mississippi's population by types of residence in 1940 and 1970



among non-whites in 1970 of 33 persons per day, or very slightly over 12,000 persons per year.

However, over a decade, the gain among whites is expected to be greater and the loss among non-whites to be smaller in each succeeding year than in the preceding one, due to the accelerating net in-migration of whites and the decelerating net out-migration among non-whites.

Population Distribution

A major redistribution of the state's population has occurred since 1940. There has been a sizable population concentration in rural non-farm areas and urban areas. The rural non-farm population in the state increased from 16.1 percent of the total population (351,030) in 1940 to 46.0 percent (1,019,277) in 1970. The urban population increased from 19.8 percent (432,882) in 1940 to 44.5 percent (987,312) in 1970 (Figure 2). On the other hand, the proportion in the rural farm population decreased from 64.1 percent (1,399,884) in 1940 to 9.5 percent (210,323) in 1970. Looking specifically at the rural population, it is clear that 55.5 percent (1,229,600) of the state's total population in 1970 was rural. Moreover, differentiation with regard to the patterns of population growth and redistribution among the state's counties is very apparent: the Gulf Coast counties are growing, while some counties in the central and northern parts of the state grow little if at all and many of the Delta counties are losing population.

Population Composition

Over a 30-year period, Mississippi's population has varied with regard to age, sex, color, education, occupation, income, and marital status, to name only a few aspects of population dynamics.

For example, the median age of the state's population increased from 23.8 years in 1940 to 25.1 years in 1970. The median age for whites in 1940 was 2.6 years higher than for non-whites (25.1 and 22.5 years, respectively), whereas in 1970 the difference between the two medians was 9.4 years (28.8 and 19.4 years for whites and non-whites, respectively). Two major implications of the change in median age are: First, the population in the working ages (15-64) in the state declined from 62 percent in 1940 to 58 percent in 1970. The second implication is that the non-white population in Mississippi is becoming "younger," due to the fact that many out-migrant parents leave their children in the state.

The sex composition of the state's population has also varied. The sex ratio of Mississippi's white population declined from 101 males to every hundred females in 1940, to 96 males to every hundred females in 1970. For the non-white population, the sex ratio dropped from 96 males to every hundred females in 1940, to 90 males for every hundred females in 1970.

Another important change is that the percentage of white population has steadily grown—both before and after 1940—while the non-white population, despite its higher birth rate, began a steady decline after 1940. The percentage of population which is non-white has declined from 49.3 (1,077,469) in 1940 to 37.2 (815,626) in 1970. This decline of the non-white population is primarily due to out-migration.

Still another important qualitative factor in a community's population is the level of education in that community. Formal education is an essential feature of any industrial, urban society. Changing occupational requirements make it impossible for any individual to participate in the complex economic activities of such a society without acquiring the essential training needed for these activities. Moreover, there is a direct relationship between the number of years of formal education an individual has attained and his income level.

That Mississippians are increasingly becoming better educated is evidenced by comparing the years of school completed by those 25 years old and over in 1940 and 1970. Between 1940 and 1970, the educational level of adults in Mississippi went up markedly, with the median schooling of all persons 25 years of age and over increasing by 3.5 years, from 7.2 to 10.7 years. In 1940, only 28.6 percent of the population had completed at least the ninth grade. But by 1970, almost two-thirds (61.3 percent) of the state's population aged 25 or over had at least a ninth grade education.

The median number of years of formal education of the white population increased by slightly more than three full years—from 8.9 in 1940 to 12.1 in 1970. Median years of formal education for the non-white population increased by almost 3 years, from 4.7 to 7.5 years during that period.

The Labor Force and Employment Status of Mississippians

Both the employment status and occupational composition of Mississippi's work force have undergone significant changes since he 1940's. The labor force[2] paricipation rate (the number of persons 14 years old and over who are classified as being in the labor force divided by the total populaion 14 years old and over) declined from 53.2 percent in 1940 to 50.1 percent in 1970.

Two major points should be noted about this declining trend. First, males have a much higher participation rate than females, but this rate has changed coniderably, from about 82 percent of he total labor force in 1940 to about 65 percent in 1970. Correspondingy, women have significantly inreased their participation rate from about 26 percent in 1940 to almost 37 percent in 1970. Second, he decrease in the labor force has esulted mainly from a decline in he participation of males among both whites and non-whites from oughly 79 to 70 percent for whites and 84 to 54 percent for non-white males in 1940 and 1970, respectivey.

Moreover, the tremendous transformation of the state's conomy has spurred remarkable changes in the occupational composition of the employed populaion between 1940 and 1970. In ome cases, the changes showed accentuated growth; in others, they appeared to mark a declining rend. Outstanding among the accentuated growth was the faster growth of white-collar occupations professional, managerial, sales, and clerical) and blue-collar occupations (craftsmen, operatives, and laborers except farm), than of other occupations. The percentage of persons employed in white-collar occupations increased from 16 percent (103,708) in 1940 to 39 percent (279,176) in 1970. Blue-collar workers, who outnumbered white-collared workers in 1940 and 1970, increased from 21 percent (129,621) in 1940 to 41 percent (297,355) in 1970. But within both groups, kinds of occupations requiring the most education and training grew most rapidly. On the other hand, the service occupations also increased their share of total employment—from 12 percent (72,478) in 1940, to 14 percent (101,277) in 1970.Service occupations have increased much more rapidly than have total employment. The rate of growth in service occupations during the thirty-year period was 29 percent, while total employment grew at the rate of 15 percent during the same period. At the same time, prevalence of large-scale establishments and institutional changes, together with the application of modern technological advances in farming and related activities, reduced the employment share of farm workers (farmers and farm managers, and farm laborers and foremen) from 51 percent (320,235) in 1940 to 6 percent (43,537) in 1970.

Finally, there was a significant improvement in the rate of unemployment (the ratio of jobless workers to the number of persons in the civilian labor force), in Mississippi. The rate of joblessness in the state decreased from 10 percent (81,007) in 1940 to 5 percent (38,373) in 1970. This reduction in unemployment rate is interesting in itself, since it is a gauge of the social and economic well-being of the state.

What, then, do these figures suggest about income levels in the state? The median family income of Mississippians increased from $1,198 in 1949 (the first year that such data were available) to $6,071 in 1969, an increase of almost 407 percent. The purchasing power of an income, however, indicates the value of that income. Based upon 1967 buying power in the United States, the real value of median family incomes in Mississippi rose from a family median income of $1,678 in 1949 to $5,531 in 1969. This was an increase of about 230 percent. In other words, the real median annual family income for Mississippi in 1969 was more than three times its level in 1949, and five times as large as its monetary value, and most Mississippians enjoy a better standard of living than they did in 1940.

At $7,350 in 1969, the median income of urban families was 34.4% above that of 1949. Rural-farm families, on the other hand, with median family income of $4,356, experienced a 61.3% increase over their medain income in 1949. Median income of urban families was three times as great as that of rural-farm families in 1949 but only 1.7 times as great in 1969.

Reduction in the gap between income levels of urban families and rural-farm families can be at-

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[2] Prior to the 1970 census of the United States, the labor force was defined as including persons 14 years old and over who, at a given time, were either employed or unemployed but looking for work. However, the definition of "labor force" in the 1970 census changed to persons 16 years old and over. For purposes of comparison, the present study utilizes data which relate to the definition of labor force prior to 1970 and includes all persons classified in the civilian labor force, plus members of the Armed Forces on active duty. Not considered in the labor force are those persons under 14 years of age and all those 14 years old and over who are doing only incidental unpaid family work (less than 15 hours during the reference week).

tributed to many factors, among which the following may be cited: (1) increase in farm productivity resulting from mechanization, fertilizer, chemical pesticides and herbicides, and other improved agricultural techniques; (2) increase in real price for farm products; (3) increasing efficiency in farm management, together with the augmentation of differentiated farm activities such as agriculture, forestry and logging and fishing; and (4) shifts in th working force from agriculture, low-wage industry, to higher paying manufacturing jobs.

The Marital Status of Mississippians

The social, economic, and psychological well-being of a society is affected by the marital composition of its population. A community with a high proportion of married females is likely to have a higher birth rate than a community with a lower proportion of married women, while at the same time, married males and females have lower death rates than single, widowed, and divorced persons of the same ages.

Mississippi census data show an interesting change between 1940 and 1970 in the marital composition of the population. As has been the case with the nation as a whole, the proportion of single persons in Mississippi decreased between 1940 and 1970 (from 28 percent to 26 percent), and that of those married increased (from 62 percent to 63 percent). The proportion widowed and divorced went from 8 percent to 9 percent and from 1 percent to 2 percent, respectively. The non-white population differs from this general pattern in that the "single" and "married" groups of the non-white population experienced a large increase in the proportion of persons single, and a sharp decrease in proportion of those married. The reversed pattern observed among the two marital groups in the non-white population is due mainly to the high rate of out-migration among non-white population. Mortality and divorce had minor effect.

At the same time, some differences exist among men and women within and between white and non-white populations. In 1940, among both males and females, whites had higher proportions single (33 percent for males and 26 percent for females) than did non-whites (31 percent for males and 23 percent for females). But by 1970, the situation was reversed between the proportions single: among both males and females, the whites had smaller proportions single (26 percent for males and 18 percent for females) than did non-whites (38 percent for males and 30 percent for females). A relatively similar pattern was observed for those married. In 194 white and non-white males had th same proportions married (63 per cent for each), while among females a slightly larger propor tion of whites were married (63 per cent for whites and 61 for non whites). By 1970, among both males and females, the whites had larger proportions married (70 per cent for males and 66 percent for females) than did non-whites (5 percent for males and 50 percent for females). Regarding widowhood the data show that the proportion widowed was higher among women than among men in both groups in 1940 and in 1970; the differences between whites and non-whites were greater for women than for men in 1940, but became equal in 1970 (Table 2). Finally data on the divorced population (Table 3) show higher proportions divorced among women than among men for both whites and non-whites in 1940 and 1970. On the other hand, among females, the whites had a slightly smaller proportion divorced than did non

Table 2. Percentages of Widowed Persons in Mississippi by Sex and Color, 1940 and 1970

	1940		1970	
Race	Males	Females	Males	Females
White	3.3	10.4	2.4	13.5
Non-white	4.9	14.4	5.7	16.7

Table 3. Percentages of Divorced Persons in Mississippi by Sex and Color, 1940 and 1970

	1940		1970	
Race	Males	Females	Males	Females
White	0.8	1.2	2.3	2.6
Non-white	0.7	1.4	1.6	2.8

hites; whereas among males the hites had a larger proportion ivorced than non-whites.

The data reflect marital status at the time of the census, so that widowed and divorced persons who are remarried are counted as married.

Epilogue

The analysis presented in this esearch has been proposed as a rief study of population dynamics the state. Its main purpose is to nticipate the near future by elating the present to the past. verything in the state is carried ut by people and for people. It is of terest, then, to shed some light on uman resources in the state in rder to foresee their needs.

In general, the data show that e birth rate for Mississippi will robably decline in the future ecause of the use of effective and cceptable means of birth control, f older age at marriage, and small amily norms. Because of improved edical care, a better way of life for e poor, and various welfare relief rojects, fewer deathes are ancipated in the 1970's than in the 960's. With the South becoming ore attractive both economically nd environmentally, chances of ore in-migration than outigration will grow from year to year from 1970-1980. This hypothesis is in part supported by the declining net out-migration figures (provided above) and by the rapid economic development which is taking place in the South today.

Given the rates[3] of annual population growth by sex and color between 1960 and 1970, the projected total population of the state in 1980 is expected to be at least 2,281,000[4] (Table 4). This projection presupposes that the trend of population growth experienced by each sex and color group in the state during the 1960's together with the relevant features of the social and economic setting, will prevail in the 1970's.

The size of the civilian labor force anticipated by 1980 is difficult to estimate, since such an estimate depends upon the labor force participation rates, which are the result of many complicated factors—including future sex and race composition, migration, educational attainment, the duration of the work week and the number of weeks of work during the year, labor productivity, economic condition and technological change. But a rough estimate of the size of the working force by 1980 may be derived from the available population of working force age.[5] If labor participation rates do not change between 1970 and 1980, one could expect that the civilian labor force would increase by 9.3 percent. This means that 70,118 workers would be coming into the labor market in Mississippi during the 1970's. This information on the expected number of the new young workers can help shape the state's policies for maximizing employment opportunities for them.

Size of school enrollment in the 1970's is related to labor participation. Projection of the number of persons who will be enrolled in educational institutions can help

Table 4.—Projected Population of Mississippi by Sex and Color, 1980

Sex	White	Non-White	Total
Male	748,000	344,000	1.092,000
Female	796,000	393,000	1,189,000
Total	1,544,000	737,000	2,281,000

---

[3] *Rates of annual population growth between 1960 and 1970, expressed in percentages, are: .8995 for white males, 1.1477 for white females, 1.2572 for non-white males, and .9610 for non-white females.*

[4] *This is a conservative estimate since it does not take into consideration the effect of the age distribution and age-specific rates of fertility, mortality and migration. Accordingly, the acutal 1980 population size in the state may exceed that figure. A population projection that is based on age, sex and color is underway.*

[5] *Assuming the age distribution of the state's population in 1980 to be the same as that of 1970, an estimate of the 1980 civilian labor force is derived by applying estimates of the proportion of persons who will be working or able and willing to work at that date. Such an estimate may be obtained by comparing the projected population, by sex and color, aged sixteen and over in 1980 (1,600,977) with that in 1970 (1,466,697).*

in the projection of the state's labor force, especially since the labor force is inversely related to educational enrollment in certain age groups. Moreover, projection of school enrollment is important in order to formulate educational policies and programs, as well as to plan for needed facilities and qualified personnel. Among the estimated 1,223,770[6] persons 5 to 34 years old in 1980, about 689,662 persons will be enrolled in schools (56.4 percent of the projected population of 5 to 34 year olds). This estimate is based on the assumption that the proportions of the population enrolled in school in 1970 will not change by 1980[7]. This assumption seems fairly reasonable, since it is known that 57.4 percent (613,370) of the 5 to 34 year olds were enrolled in school in 1960. One may observe that each succeeding census has a higher numerical enrollment (but proportionately very slightly smaller) than the preceding census.

A concluding remark regarding the quality of life in Mississippi in order: The real progress of th state cannot be measured solely terms of population growth, dolla and cents. Specifically, Mississip is avoiding many of the social an environmental problems such crime, drugs, mass transit, poll tion, and the need to ration certa resources. At the same time Mi sissippians are enjoying an i proved quality of life as reflected increased educational attainmen increased income, and increase occupational status.

---

[6] This estimate is based on separate projection for each sex and color group.

[7] The proportions enrolled in 1970 were: 54.1 for white males; 50.6 for white females; 66.8 for non-white males; 61.7 for non-white females. Total enrollment was 56.9 (647,742 persons).

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JANUARY 1975 BULLETIN 811

Beef Finishing Programs For Weanling Calves

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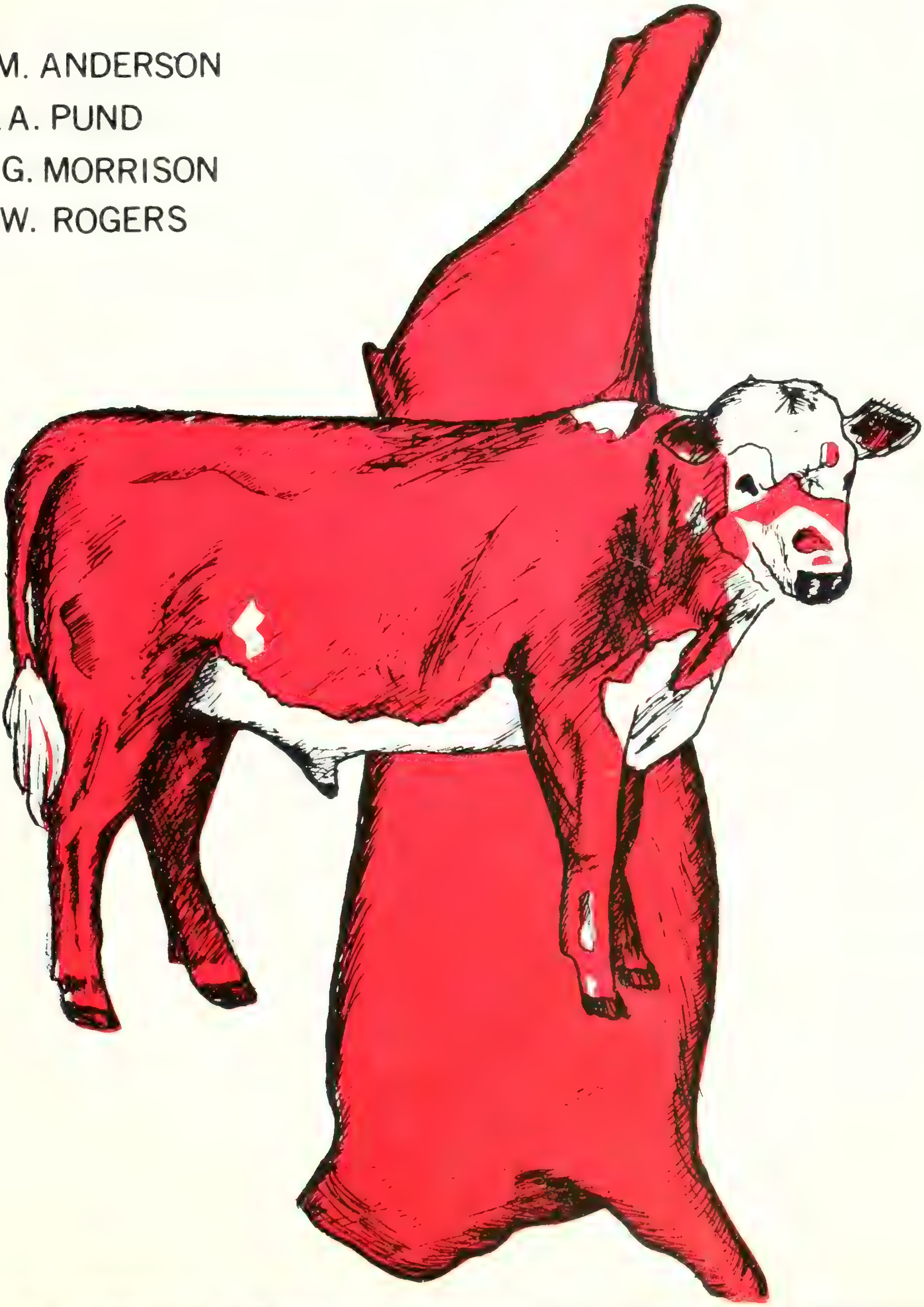

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Bulletin 811

Beef Finishing Programs for Weanling Calves

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Mississippi Agricultural and Forestry Experiment Station
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BEEF FINISHING PROGRAMS FOR WEANLING CALVES

For many years row crop agriculture in the Delta area of Mississippi was essentially a monoculture involving the production of cotton. More recently, production of soybeans has expanded to the point that, in general terms, row crop production is now bicultural. Over the past two decades, various efforts have been made to introduce other row crops that would offer Delta farmers an opportunity to increase their net returns.

One research effort to identify profitable cropping technologies involving feeding of beef cattle has been made here at the Delta Branch Experiment Station (3, 4, 5, 7). This research involved the production of various crops for use as feed for 600-700 lb. yearlings being fed to a slaughter weight of 900-1,000 lbs. Potential profits have appeared comparable to cotton and soybeans, given pre-1973 price relationships. Prior to this study data had been reported regarding the most profitable manner of producing slaughter cattle from an abundant weanling-calf resource available in Mississippi (6). About 600,000 head of cattle have been exported from Mississippi to other areas of the country for slaughter-cattle production in recent years (2).

The primary objective of this research was to evaluate various combinations of feeding programs for growing and finishing weanling steers and heifers utilizing Mississippi produced forages and feedstuffs.

Experimental Procedure

In October of each year (1969, 1970, 1971) weanling Hereford steers and heifers averaging 428 and 400 lb., respectively, were purchased at organized feeder calf sales. Following 2 to 4 weeks of conditioning on Coastal bermudagrass pasture, eight calves were blocked within sex on the basis of weight and then randomly allotted into 5 systems (Tables 1, 2, and 3). During finishing phases of the first two tests cattle from all systems were fed on a conventional slab floor feedlot, while a slatted floor feedlot was utilized during the third test.

Cattle finished on System 1 were fed in a feedlot structure throughout each test. Steers and heifers on Systems 2 and 3 were fed

Table 1. Time periods for various growing and finishing systems, 1969-71.

<table>
<tr><th></th><th colspan="2">1969</th><th colspan="12">1970</th><th colspan="2">1971</th></tr>
<tr><th>System</th><th>Nov.</th><th>Dec.</th><th>Jan.</th><th>Feb.</th><th>Mar.</th><th>Apr.</th><th>May</th><th>June</th><th>July</th><th>Aug.</th><th>Sept.</th><th>Oct.</th><th>Nov.</th><th>Dec.</th><th>Jan.</th><th>Feb.</th></tr>
<tr><td>1</td><td colspan="12">Corn silage (high cut)</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td colspan="6">Intermediate sorghum silage (high cut)</td><td colspan="8">Corn silage (high cut)</td><td></td><td></td></tr>
<tr><td>3</td><td colspan="6">Intermediate sorghum silage (high cut)</td><td colspan="4">Coastal bermudagrass pasture</td><td colspan="6">Corn silage (high cut)</td></tr>
<tr><td>4</td><td colspan="4">Dormant Coastal bermudagrass pasture plus grain and cottonseed meal</td><td colspan="3">Intermediate sorghum silage (high cut)</td><td colspan="3">Oat-wheat silage (high cut)</td><td colspan="4">Corn silage (high cut)</td><td></td><td></td></tr>
<tr><td>5</td><td colspan="7">Wheat and rye grass pasture</td><td colspan="6">Corn silage (high cut)</td><td></td><td></td><td></td></tr>
</table>

Table 2. Time periods for various growing and finishing systems, 1970-72.

	1970		1971												1972	
System	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb
1	Corn silage (high cut)	—	—	—	—	—	—	—	—	—						
2	Intermediate sorghum silage	—	—	—	—	—	Corn silage (high cut)	—	—	—	—	—	—	—		
3	Intermediate sorghum silage	—	—	—	—	—	Coastal bermudagrass pasture	—	—	—	Corn silage (high cut)	—	—	—	—	
4	Dormant Coastal bermudagrass pasture plus intermediate sorghum silage	—	—	—	—	—	Green Coastal bermudagrass pasture	—	Oat-wheat silage (high cut)	—	Corn silage (high cut)	—	—	—		
5	Wheat and rye grass pasture	—	—	—	—	—	—	—	Corn silage (high cut)	—	—					

Table 3. Time periods for various growing and finishing systems, 1971-73.

	1971		1972												1973	
System	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
1	Corn silage (high cut)	—	—	—	—	—	—	—	—	—						
2	Intermediate sorghum silage	—	—	—	—	—	Corn silage (high cut)	—	—	—	—	—				
3	Intermediate sorghum silage	—	—	—	—	—	Coastal bermudagrass pasture	—	—	—	Corn silage (high cut)	—	—	—	—	—
4	Dormant Coastal bermudagrass pasture plus intermediate sorghum silage	—	—	—	—	—	Green Coastal bermudagrass pasture	—	Oat-wheat silage (high cut)	—	Corn silage (high cut)	—	—	—	—	—
5	Wheat and rye grass pasture	—	—	—	—	—	—	Corn silage (high cut)	—	—	—	—				

in drylots approximately one-half acre in size during the winter months of the first two tests and on a slatted floor feedlot during the third test. System 3 cattle were placed on Coastal bermudagrass pasture in April of the following year at the rate of 0.80 acre per animal, with cattle rotated among three pastures. Cattle on System 4 were allowed to graze dormant Coastal bermudagrass at the rate of one animal per acre during the winter months, with supplemental feeding, followed by various subsequent summer rations prior to the final feedlot period. Steers and heifers on System 5 were shipped to the Brown Loam Experiment Station, Raymond, Mississippi, where they grazed wheat-rye grass pasture at an initial stocking rate of 500 lb. of beef per acre from November through May. They were returned to the Delta Branch Experiment Station for the feedlot finishing phase.

All animals were implanted with a combination of diethylstilbestrol and testosterone at 84-day intervals while in the feedlot. They also had free access to a trace mineral salt with calcium and phosphorus. Cattle were fed all the silage they would consume once each 24-hour period. The silage crops were routinely treated with urea and limestone (10 lb. per ton of each) at the time of ensiling.

Average weight and apparent condition were used to determine the time of slaughter of a particular group of steers or heifers. All cattle were sold on a carcass grade and yield basis.

Animal performance was measured by average daily gain, feed consumption, feed efficiency, length of time to slaughter, and carcass evaluation. Costs and returns per animal and per acre, land requirements, and adaptability to year - round use of feedlot facility were used in evaluating the overall efficiency of each system of beef production. All variables were evaluated on the basis of group means. Differences among means were determined by variance analysis and Duncan's New Multiple Range Test (8).

Data by each year and by each segment of the finishing program, as well as detailed footnotes, are included in Appendix Tables 1-24.

Results and Discussion

The length of time required for finishing 428 lb. steers and 400 lb. heifers to a USDA carcass grade of high Good to low Choice ranged from 309 to 462 days for the various systems (Table 4). System 1 required less time than did any of the other systems and the time required for finishing, when averaged over all systems, was 14 days less for heifers than for steers.

Cost calculations in this study assumed year-round use of the feedlot facilities. Our results indicate that System 2 would permit simplified year-round feedlot use with one group of cattle, and with a significantly* shorter feeding period than for either Systems 3 or 4.

Shorter feeding periods are important because they reduce the length of time that a substantial quantity of operating capital is re-

Table 4. Average animal performance, cost of gain and land resource requirements by sex, system, and year, 3 years [1]

	System					Sex		Year		
Item	1	2	3	4	5	Steers	Heifers	1969-71	1970-72	1971-73
Initial weight, lb.	413a	415a	415a	413a	413a	428	400	374	436	431
Number of days fed	309	366a	462	424	370a	393	379	394a	373a	392a
Final weight, lb.	936b	949ab	994a	959ab	969ab	1021	901	957a	966a	960a
Average daily gain, lb.	1.69	1.45a	1.25b	1.29b	1.50a	1.53	1.34	1.48a	1.44a	1.38a
Feed and pasture costs/lb. gain, cents	8.1ab	7.5b	7.8b	9.0a	10.9	8.4a	9.0a	9.0a	8.7a	8.3a
Total costs/lb. gain, cents 2/	22.3ab	21.6b	22.4ab	23.9a	26.0	22.3	24.2	22.0a	22.6a	25.1
Total production costs, $/animal 3/	255.06b	254.66b	270.01a	269.52a	282.69	285.70	247.08	245.53	261.44	292.19
Land resources required/animal, acres										
Sandy and mixed soils	0.38	0.28a	0.24a	0.18b	0.23ab	0.28	0.24	0.29a	0.25ab	0.24b
Heavy clay soils or equivalent	0.00	0.17	0.60a	0.61a	0.81	0.45a	0.43a	0.43a	0.46a	0.43a

[1] Means on the same line within each main effect (i.e., system, sex, or year) not followed by a common letter differ significantly ($P < .05$) from one another according to Duncan's New Multiple Range Test.

[2] Excludes initial purchase cost of the cattle.

[3] Includes initial purchase cost of the cattle.

**Differences noted here and elsewhere in this bulletin were significant at* $P < .05$.

quired for cattle and feed purchases. Also, more rapid turnover of cattle being finished provides more flexibility in attuning the farm's cash position to its overall capital needs.

Cattle Performance---Daily gains were greater for System 1 than for all other systems, most likely because of the greater concentration of nutrients in the high-cut corn silage. However, a contributing factor may have been the consumption of a similar ration at the same location throughout the feeding period. All cattle finished in System 2 and 5 gained at about the same rate and at higher rates than either steers or heifers in Systems 3 and 4.

The average weight of steers at the beginning of the tests was 28 lbs. more and steers gained 0.19 lb. more per day than did heifers in all systems and in all years. Steers reached the desired carcass grade at an average weight of 1021 lb., 120 lb. greater than heifers.

Steers surpassed heifers in daily gains on Systems 1, 2, and 4, but heifers and steers gained at the same rate on Systems 3 and 5. This resulted in a significant sex x system interaction (Table 5). These tests indicated that inclusion of rather extended pasture phases in growing and finishing programs (e.g., System 3, Coastal bermudagrass during the summer months or System 5, winter grazing on wheat-rye grass pasture) resulted in a smaller relative advantage for steers over heifers.

Carcass Traits---The average carcass grade for all systems approached USDA low Choice (Table 6). This was within the expected range even though individual animals occasionally fell outside the desired span in carcass grades. Cattle on System 1 had significantly greater dressing percentages than did cattle on Systems 3 and 4. Carcass conformation scores were greater for System 3 cattle than for cattle finished on Systems 2, 4, and 5. System 3 cattle also had larger loin eyes than did those cattle on Systems 1, 2, 4, and 5.

No significant differences were noted among the various systems for such carcass traits as carcass weight, marbling score, USDA carcass grade, fat thickness over the loin eye, or loin eye area and fat thickness per 100 lb. of carcass weight. Steers had significantly heavier carcasses and higher carcass conformation scores, larger total loin eye area, less loin eye area and fat cover per 100 lb. of carcass weight than heifers. Other carcass means tended to be similar for steers and heifers.

Land Requirements---Land resource requirements were divided into two categories. Sandy and mixed type soils were assumed to be required only for corn silage production. All other production occurred on heavy clay soils or their assumed equivalent. System 1 required significantly more sandy and mixed soil per animal than any

Table 5. Mean separation for sex x system interaction over 3 years [1]

	Steer systems					Heifer systems				
Item	1	2	3	4	5	1	2	3	4	5
Average daily gain, lb.	1.87	1.55a	1.30de	1.39bcd	1.55a	1.50ab	1.35cd	1.20e	1.19e	1.45ab

[1] Means not followed by a common letter differ significantly ($P < .05$) from one another according to Duncan's New Multiple Range Test.

Table 6. Average carcass characteristics by system, sex, and year, 3 years [1]

	System					Sex		Year		
Item	1	2	3	4	5	Steers	Heifers	1969-71	1970-72	1971-73
Chilled carcass weight, lb.	548a	541a	562a	540a	556a	583	516	546a	551a	552a
Dressing percent	60.4a	58.7ab	58.2b	58.1b	59.1ab	58.9a	59.0a	58.7a	58.8a	59.2a
Conformation score	12.8ab	12.6b	13.2a	12.7b	12.3b	13.2	12.2	12.7a	12.4a	13.1
Marbling score	5.3a	5.1a	4.9a	4.9a	4.9a	5.0a	5.1a	5.1a	5.0a	5.0a
USDA grade	11.8a	11.7a	12.2a	11.8a	11.6a	11.8a	11.9a	11.4b	12.3a	11.8a
Loin eye area, sq. in.	10.5a	10.5a	11.3	10.7a	10.6a	10.9	10.6	10.9a	10.2	11.0a
Fat thickness, in.	0.59a	0.63a	0.57a	0.62a	0.61a	0.61a	0.60a	0.63a	0.64a	0.55
Kidney, heart, and pelvis fat, %	3.34a	3.02ab	3.17ab	2.76b	3.00ab	2.95a	3.16a	3.48	2.84a	2.85a
Yield grade score	3.42ab	3.42ab	3.11b	3.21ab	3.50a	3.37a	3.30a	3.46a	3.48a	3.06
Loin eye area/100 lb. carcass wt., sq. in.	1.93a	1.95a	2.02a	1.99a	1.92a	1.87	2.06	2.01a	1.87	2.00a
Fat thickness/100 lb. carcass wt., in.	0.11a	0.12a	0.10a	0.12a	0.11a	0.10	0.12	0.12a	0.12a	0.10

[1] Means on the same line within each main effect (i.e., system, sex, or year) not followed by a common letter differ significantly ($P < .05$) from one another according to Duncan's New Multiple Range Test. Appropriate footnotes are included in Appendix Tables 16-18.

her system (Table 4). System 4 re ired the least amount of this soil pe per animal fed.

Systems 3, 4, and 5 were fairly ex nsive users of the heavy clay soil pes requiring an average of 0.60 0.81 acre per animal. Systems 1 d 2 required 0.00 and 0.17 acre of avy clay soil types, respectively. stem 2 was the most efficient ishing program for replacing gh producing soil types. This stem was able to substitute 0.17 re of a generally less productive il grouping for 0.10 acre of the ndy and mixed soil types. Other stems utilized less of the sandy il types, but required 0.60 to 0.81 re of heavy clay soil types to hieve the replacement.

Land resource requirements per imal unit were slightly greater r steers than for heifers. The nount of sandy and mixed soil pes required tended to decline om 1969-71 to 1971-73.

Production costs---Feed and sture costs per pound of gain were lowest for Systems 2 and 3, (7.5 and 7.8 cents, respectively). System 5 had the highest feed and pasture costs per pound of gain of all the systems evaluated (Table 4). Feed and pasture costs per unit of gain were slightly lower for steers than for heifers and tended to decline from the first through the third experiment.

Total costs per pound of gain were lowest (21.6 cents) for cattle finished on System 2. This was significantly less than Systems 4 and 5 (23.9 and 26.0 cents per pound gained, respectively).

Total costs per pound of gain were 1.9 cents lower for steers than for heifers. Total costs per unit of gain were similar during the first two experiments, but were significantly greater in the final test. The primary factor contibuting to this increase was the higher investment and depreciation costs associated with the slatted floor feedlot utilized in the final year. To a lesser extent, the higher initial purchase cost per animal unit in 1971 resulted in some increases in operating capital costs related to cattle purchase (Table 7).

Returns---Purchase and selling price relationships are very important in determining the profitability of beef finishing enterprises. No variation in cattle prices during the three trials appeared to be associated with finishing systems utilized (Table 7).

Purchase prices of steers exceeded those of heifers by $4.42 per 100 lb. In contrast, selling prices of steers were only $0.80 per 100 lb. greater than heifers, when selling price was determined on the basis of carcass weight and grade. Therefore, steers had a margin between buying and selling price of -$4.06 per 100 lb. while the margin for heifers was -$0.44 per 100 lb. Both selling and buying prices tended to increase each succeeding test year from 1969 through 1971.

le 7. Average purchase prices, selling prices, and net returns for various systems of finishing beef cattle by system, sex, and year, 3 years [1]

	System					Sex		Year		
	1	2	3	4	5	Steers	Heifers	1969-71	1970-72	1971-73
rchase price, $/hundred lb.	33.64a	33.64a	33.64a	33.64a	33.64a	35.85	31.43	31.32	32.58	37.04
ing price, $/hundred lb.	31.56a	31.44a	31.48a	31.25a	31.23a	31.79a	30.99a	27.84	31.16	35.17
al returns, $/animal	283.31a	287.02a	300.84a	288.40a	290.18a	311.49	268.41	255.76	289.64	324.46
returns to management										
/head	28.25a	32.36a	30.84a	18.88ab	7.50b	25.79a	21.34a	10.23	28.20a	32.27a
/acre	77.95a	75.90a	36.48b	24.76bc	6.94c	49.46a	39.35a	17.61	52.13a	63.48a
t returns to land and management										
/head	40.00ab	43.32a	46.69a	33.98ab	26.98b	41.07a	35.31a	25.40	42.93a	46.25a
/acre	109.11a	100.68a	55.26b	43.86bc	25.39c	72.11a	61.62a	39.77	74.56a	86.25a
t returns to land, labor and anagement										
$/head	46.22ab	49.88a	53.25a	40.48ab	33.19b	47.33a	41.88a	31.80	48.59a	53.43a
$/acre	125.75a	115.89a	63.02b	52.04bc	31.16c	82.30a	72.84a	49.70	84.18a	98.83a
t returns to land, labor, anagement and general farm overhead										
$/head	53.52ab	57.30ab	66.70a	53.46ab	50.86b	59.37a	53.36a	44.19	60.45a	64.46a
$/acre	144.89a	132.76a	80.57b	68.48bc	48.07c	98.97a	90.94a	68.36	101.03a	115.48a

[1] Means on the same line within each main effect (i.e., system, sex, or year) not followed by a common letter differ significantly ($P < .05$) from e another according to Duncan's New Multiple Range Test. Appropriate footnotes are included in Appendix Tables 19-21.

Net returns to various components of production are included in Table 7. Generally speaking, net returns per acre of land utilized were in favor of the finishing programs utilizing crops produced in intensive production, Systems 1 and 2. Only slight differences in returns to management were noted between these two systems. Since System 2 required less (0.10 acre per animal) acreage of highly productive soil types, it would seem to be the desired system under most usual available land resource conditions in the Mississippi Delta area.

Estimates of general farm overhead used in this report reflect those items necessary for support of a general Delta cotton farm operation (farm shop, pickup, office help, etc.) which are not generally assignable to a given farm enterprise. It is possible that these costs may be excessive for systems with substantial pasture acreage (Systems 3, 4, and 5). Therefore, some producers may find that the most adequate evaluation of these systems will be net returns to land, labor, management, and general farm overhead (Table 7).

When evaluated in terms of net return to management on a per animal basis, Systems 2,3,1,4 and 5 appeared in that order for all years and sexes combined. Net returns per animal to land, labor, management, and general farm overhead were greatest for System 3 ($66.70) with returns for other systems ranging from $50.86 to $57.30 per animal.

All measures of net returns wer slightly higher for steers. This ac vantage was considerably les than might be expected from th performance data, due to th greater negative price margins ir curred by steers.

The assumption that the feedl facility was utilized on a yea round basis would have to b satisfied for fixed feedlot costs an net returns reported in this study be applicable. System 2 provided length of feeding period whic would facilitate year round feedl use with one set of cattle with th least amount of difficulty. Oth systems would have to be fitte with varying weights of yearling and long yearlings to complete year of annual use.

Summary and Conclusion

Five systems of growing and finishing weanling beef steers and heifers to slaughter weight and grade were evaluated in three separate trials. All systems utilized in these trials produced carcasses averaging within the apparent desired weight (500-600 lb.) and grade (USDA high Good to low Choice) ranges. The length of feeding period necessary for achieving these desired weights and grades ranged from 309 days on System 1 to 462 days on System 3. System 2 required a feeding period of the proper length to facilitate year round feeding with one group of cattle.

Daily gains over the entire finishing period ranged from 1.25 to 1.69 lb. Cattle finished on System 1 gained significantly more per day than those on all other systems. Steers gained significantly more per day (0.19 lb.) than heifers over all years and all systems.

Feed and pasture costs and total costs per pound gained ranged from 7.5 to 10.9 cents and 21.6 to 26.0 cents, respectively, and were both lowest for cattle finished on System 2.

Sandy and mixed type soil requirements ranged from 0.18 to 0.38 acre per animal fed with System 1 having the greatest requirements. Heavy clay or equivalent soil types required from 0.00 to 0.81 acre per animal unit. System 2 was able to replace 0.10 acre of sandy and mixed soil types with 0.17 acre of soils in a heavy clay or equivalent groups.

Finishing cattle on pasture-intensive programs (Systems 3 and 5) resulted in a smaller relative advantage for steers over heifers when performance was evaluat on the basis of daily gains.

Net returns to management on per acre basis were greater for tl more intensive programs (Systen 1 and 2) than for the more extensi users of land (Systems 3, 4, and Net returns to land, labor, manag ment, and general farm overhe on a per animal basis were greate for System 3.

Over all systems and year steers returned slightly more both a per animal basis and a p acre basis than did heifers.

The results of this research poi out a need for additional efforts increase returns from cattle gra ing wheat-rye grass pasture durir the winter followed by full feedir of high cut corn silage to slaughte These efforts are currently progress.

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Appendix Table 1. Summarized results of animal performance utilizing 5 systems for growing and finishing beef cattle, 1969-71.

	Steer systems					Heifer systems				
Item	1	2	3	4	5	1	2	3	4	5
Date started (1969)	Nov. 10	Nov. 10	Nov. 10	Nov. 10	Nov. 10	Nov. 10	Nov. 10	Nov. 10	Nov. 10	Nov.
Date ended (1970, 1971)	Oct. 19	Dec. 15	Mar. 8	Dec. 15	Dec. 15	Oct. 19	Oct. 19	Mar. 8	Dec. 15	Oct.
Number days	343	400	482	400	400	343	343	482	400	343
Number animals started	8	8	8	8	8	8	8	8	8	8
Number animals ended	7	8	7	8	8	8	8	6	8	8
Avg. initial wt., lb.	383	391	395	396	382	360	366	360	351	3
Avg. final wt., lb.	1015	1018	1029	1000	1033	882	850	964	885	8
Avg. gain, lb.	632	627	632	604	651	522	484	594	534	53
Avg. daily gain, lb.	1.84	1.56	1.31	1.51	1.62	1.51	1.39	1.23	1.33	1.5
Feed and pasture costs/lb. gain[1], cents	8.1	8.1	8.2	10.1	9.8	8.9	8.4	8.5	10.4	10
Total costs/lb. gain[1], cents	20.3	19.8	20.5	24.2	22.7	22.7	20.7	21.0	25.3	23
Avg. initial condition grade[2]	8.1	8.5	8.6	8.4	8.9	8.6	8.7	8.5	8.6	8
Sandy and mixed soils, acres/animal	0.49	0.36	0.30	0.17	0.29	0.41	0.26	0.28	0.16	0.
Heavy clay soils or equivalent, acres/animal	---	0.16	0.58	0.75	0.75	---	0.23	0.59	0.59	0.

[1] Appropriate costs are shown in the footnotes of Appendix Table 19.

[2] Grade: 8 – high Standard, 9 – low Good, 10 – average Good, 11 – high Good, 12 – low Choice, 13 – average Choice.

Appendix Table 2. Summarized results of animal performance utilizing 5 systems for growing and finishing beef cattle, 1970-72.

	Steer systems					Heifer systems				
Item	1	2	3	4	5	1	2	3	4	5
Date started (1970)	Nov. 8	Nov. 8	Nov. 8	Nov. 8	Nov. 8	Nov. 8	Nov. 8	Nov. 8	Nov. 8	Nov.
Date ended (1971, 1972)	Aug. 31	Dec. 8	Jan. 11	Dec. 8	Dec. 8	Aug. 31	Oct. 26	Jan. 11	Dec. 8	Oct. 2
Number days	296	395	428	395	395	296	352	428	395	352
Number animals started	8	8	8	8	8	8	8	8	8	8
Number animals ended	8	8	8	8	8	8	8	8	8	8
Avg. initial wt., lb.	448	446	449	448	448	425	423	423	422	42
Avg. final wt., lb.	1008	1042	1016	997	1113	882	874	939	881	91
Avg. gain, lb.	561	596	567	547	665	458	451	515	459	48
Avg. daily gain, lb.	1.89	1.51	1.32	1.39	1.68	1.55	1.28	1.20	1.16	1.3
Feed and pasture costs/lb gain[1], cents	7.4	7.6	7.3	8.0	10.5	8.5	8.2	7.9	9.4	11.
Total costs/lb. gain[1], cents	19.7	19.8	20.7	21.7	24.2	22.8	22.0	22.0	25.0	27.
Initial live condition grade[2]	8.50	8.60	9.10	8.90	8.50	9.00	8.90	8.50	8.80	8.6
Final live condition grade[2]	12.25	12.50	11.63	11.88	13.25	12.13	12.50	12.00	11.75	12.1
Sandy and mixed soils, acres/animal	0.37	0.32	0.22	0.17	0.29	0.35	0.25	0.21	0.16	0.2
Heavy clay soils or equivalent, acres/animal	---	0.18	0.63	0.60	0.90	---	0.18	0.63	0.59	0.8

[1] Appropriate costs are shown in the footnotes of Appendix Table 20.

[2] Same as Appendix Table 1.

ppendix Table 3. Summarized results of animal performance utilizing 5 systems for growing and finishing beef cattle, 1971-73.

	Steer systems					Heifer systems				
em	1	2	3	4	5	1	2	3	4	5
ate started (1971)	Nov. 2	Nov. 2	Nov. 2	Nov. 2	Nov. 2	Nov. 2	Nov. 2	Nov. 2	Nov. 2	Nov. 2
ate ended (1972, 1973)	Aug. 16	Oct. 19	Feb. 19	Feb. 19	Nov. 9	Aug. 16	Oct. 19	Feb. 19	Feb. 19	Oct. 19
umber days	289	353	476	476	374	289	353	476	476	353
umber animals started	8	8	8	8	8	8	8	8	8	8
umber of animals finished	8	8	8	8	8	8	8	8	7	7
vg. initial wt., lb.	447	447	447	447	447	415	417	416	416	415
vg. final wt., lb.	992	1005	1048	1053	949	834	904	970	936	913
vg. gain, lb.	545	558	601	605	503	419	487	554	519	498
vg. daily gain, lb.	1.89	1.58	1.26	1.27	1.34	1.45	1.38	1.16	1.09	1.41
eed and pasture costs/lb. ain[1], cents	7.4	6.4	7.1	7.7	11.7	8.5	6.3	7.6	8.5	11.5
otal costs/lb. gain[1], cents	22.0	22.2	24.5	22.2	29.8	26.4	25.0	26.0	24.8	28.3
ndy and mixed soils, acres/animal	0.36	0.24	0.22	0.24	0.19	0.31	0.23	0.22	0.21	0.20
eavy clay soils or equivalent acres/animal	---	0.13	0.60	0.54	0.89	---	0.13	0.60	0.57	0.83

---

[1] Appropriate costs are shown in the footnotes of Appendix Table 21.

ppendix Table 4. Animal performance during high cut corn silage feeding periods, 1969-71.

	Steer systems					Heifer systems				
em	1	2	3	4	5	1	2	3	4	5
ate started (1969, 1970)	Nov. 10	Apr. 14	Aug. 31	Aug. 31	May 27	Nov. 10	Apr. 14	Aug. 31	Aug. 31	May 27
ate ended (1970, 1971)	Oct. 19	Dec. 15	Mar. 8	Dec. 15	Dec. 15	Oct. 19	Oct. 19	Mar. 8	Dec. 15	Oct. 19
umber days	343	245	187	106	202	343	188	187	106	145
umber animals	7	8	7	8	8	8	8	6	8	8
vg. initial wt., lb.	383	473	629	817	694	360	449	600	699	654
vg. final wt., lb.	1015	1018	1029	1000	1033	882	850	964	885	893
vg. gain, lb.	632	545	400	183	339	522	392	364	186	239
vg. daily gain, lb.	1.84	2.22	2.14	1.73	1.68	1.51	2.08	1.95	1.75	1.64
vg. feed consumed/animal/ lay, lb.	37.4	40.8	44.3	45.2	40.3	33.5	38.9	42.5	42.3	36.3
eed required/lb. gain, lb.	20.3	18.3	20.7	26.2	24.0	22.1	18.7	21.8	24.1	22.2
eed cost/lb. gain, cents	7.3	6.6	7.5	9.4	8.6	8.0	6.7	7.9	8.7	8.0
eef produced/acre, lb.	1381	1530	1352	1069	1167	1271	1497	1282	1162	1261
cres required/animal	0.49	0.36	0.30	0.17	0.29	0.41	0.26	0.28	0.16	0.19

Appendix Table 5. Animal performance during high cut corn silage feeding periods, 1970-72.

	Steer systems					Heifer systems				
Item	1	2	3	4	5	1	2	3	4	5
Date started (1970, 1971)	Nov. 8	Apr. 12	Aug. 31	Aug. 25	May 31	Nov. 8	Apr. 12	Aug. 31	Aug. 25	May
Date ended (1971, 1972)	Aug. 31	Dec. 8	Jan. 11	Dec. 8	Dec. 8	Aug. 31	Oct. 26	Jan. 11	Dec. 8	Oct.
Number days	296	240	132	105	191	296	198	132	105	148
Number animals	8	8	8	8	8	8	8	8	8	8
Avg. initial wt., lb.	448	496	665	794	753	425	458	621	721	6
Avg. final wt., lb.	1008	1042	1016	997	1113	885	874	939	881	9
Avg. gain, lb.	561	546	351	203	360	458	415	318	160	2
Avg. daily gain, lb.	1.89	2.28	2.66	1.93	1.88	1.55	2.10	2.41	1.52	1.
Avg. feed consumed/animal/ day, lb.	34.9	37.6	46.9	45.3	41.9	32.6	35.2	45.5	43.5	37
Feed required/lb. gain, lb.	18.4	16.5	17.6	23.4	22.2	21.1	16.8	18.9	28.6	24
Feed cost/lb. gain, cents	7.1	6.3	6.8	9.0	8.5	8.1	6.5	7.3	11.0	9
Beef produced/acre, lb.	1522	1697	1591	1197	1261	1327	1667	1481	979	114
Acres required/animal	0.37	0.32	0.22	0.17	0.29	0.35	0.25	0.21	0.16	0.2

Appendix Table 6. Animal performance during high energy corn silage feeding periods, 1971-73.

	Steer systems					Heifer systems				
Item	1	2	3	4	5	1	2	3	4	5
Date started (1971, 1972)	Nov. 2	Apr. 11	Sept. 5	Aug. 28	May 29	Nov. 2	Apr. 11	Sept. 5	Aug. 28	May 2
Date ended (1972, 1973)	Aug. 16	Oct. 19	Feb. 19	Feb. 19	Nov. 9	Aug. 16	Oct. 19	Feb. 19	Feb. 19	Oct. 1
Number days	289	192	168	176	165	289	192	168	176	144
Number animals	8	8	8	8	8	8	8	8	7	7
Avg. initial wt., lb.	447	590	742	716	694	415	536	678	658	71
Avg. final wt., lb.	992	1005	1048	1053	949	834	904	970	936	91
Avg. gain, lb.	545	415	306	336	255	419	368	293	277	20
Avg. daily gain, lb.	1.89	2.16	1.82	1.91	1.55	1.45	1.92	1.74	1.57	1.4
Avg. feed consumed/animal/ day, lb.	34.7	34.4	37.5	38.6	32.1	30.3	33.6	36.7	34.0	33.
Feed required/lb. gain, lb.	18.4	15.9	20.1	20.2	20.8	20.9	17.6	21.1	21.6	27.
Feed cost/lb. gain, cents	7.1	6.1	7.7	7.8	8.0	8.0	6.8	8.1	8.3	10.
Beef produced/acre, lb.	1522	1761	1393	1386	1346	1340	1591	1327	1296	102
Acres required/animal	0.36	0.24	0.22	0.24	0.19	0.31	0.23	0.22	0.21	0.2

Apendix Table 7. Animal performance during intermediate sorghum silage (high cut) feeding periods, 1969-71.

	Steer systems			Heifer systems		
Im	2	3	4	2	3	4
Dte started (1969, 1970)	Nov. 10	Nov. 10	Mar. 2	Nov. 10	Nov. 10	Mar. 2
Dte ended (1970)	Apr. 14	Apr. 14	Jun. 19	Apr. 14	Apr. 14	Jun. 19
Nmber days	155	155	109	155	155	109
Nmber animals	8	8	8	8	8	8
Ag. initial wt., lb.	391	395	465	366	360	410
Ag. final wt., lb.	473	464	695	449	424	610
Ag. gain, lb.	82	69	230	83	64	200
Ag. daily gain, lb.	0.51	0.43	2.11	0.51	0.40	1.84
Fd consumed/animal/ dy, lb.	23.8	23.8	35.9	23.7	23.7	31.3
Fd required/lb. gain, lb.	46.7	55.4	15.7	46.5	59.3	16.1
Fd cost/lb. gain, cents	12.6	15.0	4.2	12.6	16.0	4.3
Bf produced/acre, lb.	493	415	1465	495	388	1429
Aes required/animal	0.17	0.17	0.17	0.17	0.17	0.15

Apendix Table 8. Animal performance during intermediate sorghum silage feeding periods, 1970-72.

	Steer systems			Heifer systems		
Itn	2	3	4	2	3	4
De started (1970)	Nov. 8	Nov. 8	Nov. 8	Nov. 8	Nov. 8	Nov. 8
De ended (1971)	Apr. 12	Apr. 12	Apr. 13	Apr. 12	Apr. 12	Apr. 13
Nnber days	155	155	156	155	155	156
Nmber animals	8	8	8	8	8	8
A. initial wt., lb.	446	449	448	423	423	422
A. final wt., lb.	496	492	525	458	464	448
A. gain, lb.	50	43	77	35	41	26
A. daily gain, lb.	0.32	0.28	0.50	0.23	0.26	0.17
Fd consumed/animal/day, lb.	22.8	22.8	21.5	22.8	22.8	19.0
Fd required/lb. gain, lb.	70.6	82.8	43.2	100.4	86.7	112.7
Fd cost/lb. gain, cents	14.2	16.7	8.7	20.2	17.4	22.7
Bf produced/acre, lb.	510	435	833	359	415	319
Aes required/animal	0.10	0.10	0.09	0.10	0.10	0.08

Appendix Table 9. Animal performance during intermediate sorghum silage feeding period, 1971-73.

Item	Steer systems			Heifer systems		
	2	3	4	2	3	4
Date started (1971)	Nov. 2	Nov. 2	Nov. 2	Nov. 2	Nov. 2	Nov. 2
Date ended (1972)	Apr. 10	Apr. 10	Apr. 10	Apr. 10	Apr. 10	Apr. 0
Number days	161	161	161	161	161	16
Number animals	8	8	8	8	8	8
Avg. initial wt., lb.	447	447	447	417	416	46
Avg. final wt., lb.	590	550	468	536	522	46
Avg. gain, lb.	143	103	21	119	106	0
Avg. daily gain, lb.	0.89	0.64	0.13	0.74	0.66	0.2
Feed consumed/animal/day/lb.	29.0	29.0	23.2	29.0	29.0	22
Feed required/lb. gain, lb.	32.7	45.2	180.0	39.1	43.9	186
Feed cost/lb. gain, cents	6.6	9.1	36.2	7.9	8.8	37
Pasture cost/lb. gain, cents	---	---	7.6	---	---	0
Beef produced/acre, lb.	1101	796	120	921	820	4
Crop acres required/animal	0.13	0.13	0.10	0.13	0.13	0.0
Pasture acres required/animal	---	---	0.08	---	---	0.8

Appendix Table 10. Animal performance during selected pasture periods, 1969-71.

Item	Steer Systems			Heifer systems		
	3	4	5	3	4	5
Date started (1969, 1970)	Apr. 14	Nov. 10	Nov. 10	Apr. 14	Nov. 10	Nov. 0
Date ended (1970)	Aug. 31	Mar. 2	May 27	Aug. 31	Mar. 2	May 7
Number days	139	112	198	139	112	19
Number animals	7	8	8	6	8	8
Avg. initial wt., lb.	464	396	382	443	351	0
Avg. final wt., lb.	629	465	734	600	410	0
Avg. gain, lb.	165	69	352	157	59	0
Avg. daily gain, lb.	1.19	0.61	1.75	1.13	0.52	1.7
Feed consumed/animal/day, lb.	---	4.6	---	---	4.6	--
Feed required/lb. gain, lb.	---	7.5	---	---	8.8	--
Feed and pasture cost/lb. gain, cents	7.1	26.9	11.6	6.6	31.6	14
Beef produced/acre, lb.	232	46	416	188	39	2
Pasture acres required/animal	0.71	1.00	0.75	0.71	1.00	0.5

pendix Table 11. Animal performance during selected pasture periods, 1970-72.

	Steer systems			Heifer systems		
m	3	4	5	3	4	5
te started (1970, 1971)	Apr. 12	Apr. 13	Nov. 8	Apr. 12	Apr. 13	Nov. 8
te ended (1971)	Aug. 31	Jun. 15	May 31	Aug. 31	Jun. 15	May 31
mber days	141	63	204	141	63	204
mber animals	8	8	8	8	8	8
g. initial wt., lb.	492	525	448	464	448	424
g. final wt., lb.	665	671	785	621	586	714
g. gain, lb.	173	146	337	157	138	291
g. daily gain, lb.	1.22	2.31	1.54	1.11	2.19	1.33
sture costs/lb. gain, cents	7.3	8.3	10.9	8.0	9.1	12.0
ef produced/acre, lb.	346	635	374	314	600	342
res required/animal number	0.50	0.23	0.90	0.50	0.23	0.85

pendix Table 12. Animal performance during selected pasture periods, 1971-73.

	Steer systems			Heifer systems		
n	3	4	5	3	4	5
te started (1971, 1972)	Apr. 11	Apr. 11	Nov. 2	Apr. 11	Apr. 11	Nov. 2
te ended (1972)	Sept. 4	Jun. 13	May 29	Sept. 4	Jun. 13	May 29
mber days	147	64	210	147	64	210
mber animals	8	8	8	8	7	7
g. initial wt., lb.	550	468	447	522	430	415
g. final wt., lb.	742	601	694	678	540	711
g. gain, lb.	192	133	247	155	110	296
g. daily gain, lb.	1.31	2.08	1.18	1.05	1.72	1.41
ture cost/lb., gain, cents	4.1	2.6	14.9	5.1	3.1	11.5
ef produced/acre, lb.	406	633	278	330	524	357
ture acres required/animal	0.47	0.21	0.89	0.47	0.21	0.83

Appendix Table 13. Animal performance during the oat-wheat silage feeding period, 1969-71.

Item	System 4	
	Steers	Heifers
Date started (1970)	Jun. 19	Jun. 19
Date ended (1970)	Aug. 31	Aug. 31
Number days	73	73
Number animals	8	8
Avg. initial wt., lb.	695	610
Avg. final wt., lb.	817	699
Avg. gain, lb.	122	89
Avg. daily gain, lb.	1.67	1.22
Feed consumed/animal/day, lb.	42.8	34.9
Feed required/lb. gain, lb.	25.7	28.7
Feed cost/lb. gain, cents	10.3	11.5
Beef produced/acre, lb.	441	395
Acres required/animals	0.28	0.22

Appendix Table 14. Animal performance during the oat-wheat silage feeding period, 1970-72.

Item	System 4	
	Steers	Heifers
Date started (1971)	Jun. 15	Jun. 15
Date ended (1971)	Aug. 25	Aug. 25
Number days	71	71
Number animals	8	8
Avg. initial wt., lb.	671	586
Avg. final wt., lb.	794	721
Avg. gain, lb.	123	135
Avg. daily gain, lb.	1.72	1.90
Feed consumed/animal/day, lb.	37.4	37.0
Feed required/lb. gain, lb.	20.8	18.6
Feed cost/lb. gain, cents	8.7	7.8
Beef produced/acre, lb.	542	606
Acres required/animal	0.23	0.22

Appendix Table 15. Animal performance during the oat-wheat silage feeding period, 1971-73.

Item	System 4	
	Steers	Heifers
Date started (1972)	Jun. 14	Jun. 14
Date ended (1972)	Aug. 27	Aug. 27
Number days	75	75
Number animals	8	7
Avg. initial wt., lb.	601	540
Avg. final wt., lb.	716	658
Avg. gain, lb.	115	118
Avg. daily gain, lb.	1.54	1.58
Feed consumed/animal/day, lb.	23.5	26.8
Feed required/lb. gain	15.2	17.0
Feed cost/lb., gain, cents	6.4	7.1
Beef produced/acre, lb.	742	664
Acres required/animal	0.15	0.18

endix Table 16. Carcass data by system, 1969-71.

	Steer systems					Heifer systems				
	1	2	3	4	5	1	2	3	4	5
led carcass wt., lb.	589	575	592	560	594	505	475	567	492	507
ssing percent	59.82	58.23	59.31	57.73	59.28	59.03	57.61	60.64	57.31	58.53
formation score[1]	13.30	13.13	13.30	12.86	13.38	11.88	11.85	13.00	12.25	11.63
bling score[2]	5.28	4.75	5.14	5.14	5.13	5.25	5.00	5.00	4.88	5.13
A grade[1]	10.29[3]	11.25	12.00	11.00	11.63	11.50	11.29	12.17	11.63	11.38
eye area, sq. in.	11.02	10.40	11.19	10.71	10.97	10.85	10.64	11.46	10.81	11.14
thickness, in.	0.69	0.66	0.60	0.59	0.73	0.59	0.60	0.62	0.61	0.65
ney, heart and pelvis fat, %	3.57	3.50	3.43	3.36	3.63	3.44	3.50	3.50	3.44	3.44
d grade score[4]	3.69	3.73	3.40	3.39	3.90	3.16	3.17	3.30	3.19	3.65
color[5]	1.14	1.00	1.00	1.00	1.25	1.14	1.00	1.00	1.00	1.88
eye area/100 lb. cass wt., sq. in.	1.87	1.81	1.89	1.91	1.85	2.15	2.24	2.02	2.20	2.20
thickness/100 lb. cass wt., in.	0.117	0.114	0.101	0.105	0.122	0.116	0.126	0.109	0.123	0.128

[1] 10 - average Good; 11 - high Good; 12 - low Choice; 13 - average Choice; 14 - high Choice.

[2] 4 - slight; 5 - small; 6 - modest.

[3] This group had an unusually high proportion of dark cutting carcasses. Based on other years' results, this did not appear to be associated with the icular finishing system.

[4] Calculated percent boneless, trimmed round, rib, loin, and chuck; 2 = 52.3%, 3 = 50.0%, 4 = 47.7%.

[5] 1 - white; 2 - creamy white.

Appendix Table 17. Carcass data by system, 1970-72.

Item	Steer systems					Heifer systems				
	1	2	3	4	5	1	2	3	4	5
Chilled carcass wt., lb.	582	607	562	558	641	524	501	499	500	53
Dressing percent	59.52	60.06	57.03	57.70	59.37	61.25	59.10	54.79	58.51	60.3
Conformation score[1]	13.00	12.63	13.90	12.37	12.00	12.50	11.88	11.86	11.88	11.7
Marbling score[2]	5.13	6.00	4.75	4.38	4.75	5.25	4.75	5.00	4.88	4.8
USDA grade[1]	11.75	12.63	11.50	10.50	11.25	11.88	11.38	11.29	11.38	11.5
Loin eye area, sq. in.	9.92	10.62	11.37	10.06	10.41	10.52	9.50	10.06	9.53	10.4
Fat thickness, in.	0.51	0.89	0.56	0.74	0.59	0.56	0.58	0.63	0.62	0.6
Kidney, heart and pelvis fat, %	3.00	2.56	3.43	1.81	2.38	3.13	3.13	3.28	2.44	3.2
Yield grade score[3]	3.46	4.09	3.05	3.30	3.61	3.18	3.57	3.44	3.41	3.6
Loin eye area/100 lb. carcass wt., sq. in.	1.70	1.75	2.02	1.80	1.62	2.01	1.90	2.02	1.91	1.9
Fat thickness/100 lb. carcass wt., in.	0.087	0.146	0.099	0.132	0.092	0.106	0.115	0.126	0.124	0.1

[1] 10 – average Good; 11 – high Good; 12 – low Choice; 13 – average Choice; 14 – high Choice.

[2] 4 – slight; 5 – small; 6 – modest.

[3] Calculated percent boneless, trimmed round, rib, loin, and chuck; 2 = 52.3%, 3 = 50.0%, 4 = 47.7%.

Appendix Table 18. Carcass data by system, 1971-73.

Item	Steer systems					Heifer systems				
	1	2	3	4	5	1	2	3	4	5
Chilled carcass wt., lb.	595	568	596	595	530	495	519	554	534	529
Dressing percent	61.82	58.27	58.64	58.40	57.60	61.15	59.13	58.84	58.85	59.72
Conformation score[1]	13.88	13.25	14.13	13.88	12.75	12.13	12.63	13.13	12.71	12.14
Marbling score[2]	5.50	4.60	4.53	4.63	4.78	5.47	5.28	5.10	5.57	4.68
USDA grade[1]	12.75	11.25	11.30	11.38	11.38	12.13	12.13	12.00	12.43	11.57
Loin eye area, sq. in.	10.67	11.32	12.13	11.97	10.26	10.13	10.42	11.67	11.34	10.47
Fat thickness, in.	0.64	0.49	0.46	0.54	0.44	0.57	0.55	0.55	0.64	0.58
Kidney, heart and pelvis fat, %	3.25	2.50	2.69	2.69	2.50	3.63	2.94	2.69	2.79	2.79
Yield grade score[3]	3.66	2.83	2.63	2.86	2.89	3.34	3.16	2.86	3.10	3.31
Loin eye area/100 lb. carcass wt., sq. in.	1.79	1.99	2.04	2.01	1.94	2.05	2.01	2.11	2.12	1.98
Fat thickness/100 lb. carcass wt., in.	0.108	0.086	0.077	0.091	0.083	0.115	0.106	0.099	0.120	0.10

[1] 10 – average Good; 11 – high Good; 12 – low Choice; 13 – average Choice; 14 – high Choice.

[2] 4 – slight; 5 – small; 6 – modest.

[3] Calculated percent boneless, trimmed round, rib, loin, and chuck; 2 = 52.3%, 3 = 50.0%, 4 = 47.7%.

ndix Table 19. Costs and returns for various systems of finishing steers and heifers, 1969-71.

n	Steer systems					Heifer systems				
	1	2	3	4	5	1	2	3	4	5
ns										
ng price,[1] $/hundred lb.	27.68	27.74	28.13	27.91	27.99	27.85	27.51	28.34	27.80	27.46
tal returns, $/head	269.65	271.08	277.96	267.96	276.56	235.68	224.52	262.47	236.32	235.36
s										
hase price,[2] $/hundred lb.	33.68	33.68	33.68	33.68	33.68	28.95	28.95	28.95	28.95	28.95
hase price, $/head	128.99	131.69	133.04	133.37	128.66	104.22	104.22	105.96	101.61	104.22
llot costs,[3] $/head	19.34	13.82	10.55	16.24	11.40	19.34	10.60	10.55	16.24	8.18
l costs, $/head										
justment period	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
n silage,[4] high energy	49.45	38.27	31.82	18.38	31.18	44.29	28.06	30.53	17.20	20.32
ghum silage[5]	––	10.83	10.83	11.10	––	––	10.77	10.77	9.66	––
-wheat silage[6]	––	––	––	12.98	––	––	––	––	10.53	––
in and cottonseed meal[7]	––	––	––	15.12	––	––	––	––	15.12	––
ure costs, $/head										
astal bermudagrass[8]	––	––	7.13	1.22	––	––	––	7.13	1.22	––
eat-rye winter grazing[9]	––	––	––	––	30.80	––	––	––	––	30.80
rest costs, $/head										
tle purchase[10]	9.70	11.54	14.05	11.69	11.28	7.83	7.83	11.19	8.91	7.83
ed and pasture[11]	2.93	2.68	2.19	2.21	2.18	2.63	1.84	2.13	2.01	1.96
or and miscellaneous items[12]	0.83	0.96	1.15	0.97	0.80	0.83	0.78	1.15	0.97	0.73
ellaneous items,[13] $/head	15.06	15.06	15.06	15.06	15.06	15.06	15.06	15.06	15.06	15.06
r costs,[14] $/head	6.89	6.84	6.72	7.18	5.54	6.89	5.70	6.72	7.18	4.39
eral farm overhead,[15] $/head	7.70	8.74	12.27	15.46	17.42	6.90	7.14	12.03	14.03	15.73
charge,[16] $/head	14.33	13.58	15.77	16.60	20.29	12.84	10.61	15.37	15.15	17.14
tal costs, $/head	257.22	256.01	262.58	279.58	276.62	222.83	204.61	230.59	36.89	228.36

Selling price – average of prices received for Good and Choice cattle sold during the period October 1970 – March 1971 inclusive, Chicago weekly et quotation.

Purchase price – average of prices for Good grade steers and heifers sold in Tennessee feeder calf sales, fall 1969.

Feedlot costs – includes depreciation, interest on investment, repairs and maintenance, and electricity for the period cattle were maintained in a loor type feedlot. Year round capacity feeding was assumed in proportioning these costs.

Corn silage costs – $104.89 per acre to produce and ensile with supplemental urea and limestone and $2.62 per acre interest on operating capital, 14 per acre.

Intermediate sorghum silage (high cut) costs – $63.71 per acre to produce and ensile with supplemental urea and limestone and $1.56 per acre est on operating capital, 11.5 tons per acre.

Oak-wheat silage costs – $45.40 per acre to produce and ensile with supplemental urea and limestone and $1.81 per acre interest on operating tal, 5.6 tons per acre.

Grain (corn) and cottonseed meal, $.025/lb. and $.04/lb., respectively.

Coastal bermudagrass pasture establishment and maintenance costs, Mississippi Agric. Expt. Sta. Bul. 631, pp. 12-13, revised to reflect 1970-71 costs. r round grazing was assumed in proportioning these costs.

Wheat-rye grass winter grazing costs, $41.06/acre, personal communication with Mr. E. G. Morrison, Supt., Brown Loam Expt. Sta., Raymond, Miss. r round use of the land area for winter grass production was assumed.

[0] Cattle purchase interest costs, 8% annual interest rate on initial purchase cost for the period the cattle were kept.

[11] Feed and pasture interest costs, 5% annual interest rate on the cost of the particular feed from average harvest date to the time the cattle were sold.

[12] Labor and miscellaneous items interest cost, 8% annual interest rate for one-half of the total feeding period.

[13] Miscellaneous items include (dollars per head): transportation – $6.35, insurance – $1.67, veterinary expense – $1.67, fuel – $1.31, insecticide – 38, salt – $0.59, death losses – $2.89, and implants – $0.20.

[14] Labor costs: $1.50 per hour.

[15] General farm overhead, $16.75 per acre, "Costs of Producing Upland Cotton in the United States, 1966," p. 12, USDA, ERS.

[16] Land charge: sandy soils, $31.16 per acre, same source as in footnote 15; clay soils or equivalent, $15.00 per acre.

Appendix Table 20. Costs and returns for various systems of finishing steers and heifers, 1970-72.

Item	Steer systems 1	2	3	4	5	Heifer systems 1	2	3	4	5
Returns										
Selling price,[1] $/hundred lb.	32.05	32.89	31.84	30.92	31.61	30.76	30.37	30.30	30.35	30.5
Total returns, $/head	310.58	328.73	310.73	296.05	337.88	260.43	255.00	273.12	256.78	267.0
Costs										
Purchase price[2] $/hundred lb.	35.05	35.05	35.05	35.05	35.05	30.10	30.10	30.10	30.10	30.1
Purchase price, $/head	157.02	156.32	157.37	157.02	157.02	127.92	127.32	127.32	127.02	127.6
Feedlot costs,[3] $/head	16.58	13.44	7.40	9.86	10.70	16.58	11.08	7.40	9.86	8.2
Feed costs, $/head										
Adjustment period	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.0
Corn silage,[4] high energy	39.66	34.65	23.77	18.24	30.76	37.05	26.76	23.06	17.64	21.2
Intermediate sorghum silage[5]	--	7.11	7.11	6.75	--	--	7.11	7.11	6.75	--
Oat-wheat silage[6] (high cut)	--	--	--	11.11	--	--	--	--	10.99	--
Pasture costs, $/head										
Coastal bermudagrass[7]	--	1.26	8.48	5.88	--	--	1.26	8.48	5.85	--
Wheat-rye winter grazing[8]	--	--	--	--	36.95	--	--	--	--	34.9
Interest costs, $/head										
Cattle purchase[9]	10.70	14.05	15.28	14.11	14.11	8.72	10.24	12.36	11.41	10.2
Feed and pasture[10]	1.95	2.00	1.51	1.46	3.01	1.82	1.46	1.50	1.44	2.3
Labor and miscellaneous items[11]	0.68	0.94	0.95	0.92	0.86	0.68	0.81	0.95	0.92	0.7
Miscellaneous items,[12] $/head	15.06	15.06	15.06	15.06	15.06	15.06	15.06	15.06	15.06	15.0
Labor costs,[13] $/head	5.95	6.73	5.26	6.23	4.86	5.95	5.87	5.25	6.23	3.9
General farm overhead,[14] $/head	6.20	8.29	14.20	12.91	19.93	5.86	7.12	14.19	12.58	17.5
Land charge,[15] $/head	11.53	12.60	16.28	14.31	22.54	10.91	10.42	15.96	13.85	18.9
Total costs, $/head	267.33	274.45	274.67	275.86	317.80	232.55	226.51	240.65	241.60	263.0

[1] Selling price – average of Omaha, Nebraska, market prices for given weight, grade, and sex of cattle sold during the period September 1, 19 January 7, 1972, inclusive.

[2] Purchase price – average of prices for Good grade steers and heifers sold in Tennessee feeder calf sales, fall 1970.

[3] Feedlot costs – includes depreciation, interest on investment, repairs and maintenance, and electricity for the period cattle were maintaine slab-floor type feedlot. Year round capacity feeding was assumed in proportioning these costs.

[4] Corn silage costs – $104.89 per acre to produce and ensile with supplemental urea and limestone and $2.62 per acre interest on operating capit tons per acre.

[5] Intermediate silage costs – $70.48 per acre to produce and ensile with supplemental urea and limestone and $1.96 per acre interest on ope capital, 18 tons per acre.

[6] Oat-wheat silage costs – $45.40 per acre to produce and ensile with supplemental urea and limestone and $1.81 per acre interest on ope capital, 5.6 tons per acre.

[7] Coastal bermudagrass pasture establishment and maintenance costs, Mississippi Agric. Expt. Sta. Bul. 631, pp. 12-13, revised to reflect 1970-71 Year round grazing was assumed in proportioning these costs.

[8] Wheat-rye grass winter grazing costs, $41.06/acre, personal communication with Mr. E. G. Morrison, Supt., Brown Loam Expt. Sta., Raymond, Year round use of the land area for winter grass production was assumed.

[9] Cattle purchase interest costs, 8% annual interest rate on initial purchase cost for the period the cattle were kept.

[10] Feed and pasture interest costs, 5% annual interest rate on the cost of the particular feed from average harvest date to the time the cattle were

[11] Labor and miscellaneous items interest cost, 8% annual interest rate for one-half of the total feeding period.

[12] Miscellaneous items include (dollars per head): transportation–$6.35, insurance–$1.67, veterinary expense–$1.67, fuel–$1.31, insecticide–$ salt–$0.59, death losses–$2.89, and implants–$0.20.

[13] Labor costs: $1.50 per hour.

[14] General farm overhead, $16.75 per acre. "Costs of Producing Upland Cotton in the United States, 1966," p. 12, USDA, ERS.

[15] Land charge: sandy soils, $31.16 per acre, same source as in footnote 14; clay soils, $15.00 per acre

ndix Table 21. Costs and returns for various systems of finishing steers and heifers, 1971-73.

	Steer systems					Heifer systems				
n	1	2	3	4	5	1	2	3	4	5
ns										
ng price,[1] $/hundred lb.	36.16	35.41	35.41	35.54	35.54	34.84	34.72	34.84	34.97	34.26
al returns, $/head	344.36	341.56	356.17	359.21	323.86	279.14	301.24	324.61	314.08	300.36
s										
hase price,[2] $/hundred lb.	38.83	38.83	38.83	38.83	38.83	35.25	35.25	35.25	35.25	35.25
hase price, $/head	173.57	173.57	173.57	173.57	173.57	146.29	146.99	146.64	146.64	146.29
llot costs,[3] $/head	26.97	33.92	30.60	16.28	15.35	26.97	33.92	30.60	16.28	13.39
costs, $/head										
justment period	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
n silage,[4] high energy	38.50	25.36	24.19	26.09	20.34	33.62	24.77	23.68	22.98	21.18
ermediate sorghum silage[5]	--	8.39	8.39	7.52	--	--	8.39	8.39	7.52	--
-wheat silage (high cut)[6]	--	--	--	7.38	--	--	--	--	8.41	--
ure costs, $/head										
stal bermudagrass[7]	--	--	7.96	3.46	--	--	--	7.96	3.46	--
eat-rye winter grazing[8]	--	--	--	--	36.71	--	--	--	--	34.08
est costs, $/head										
le puchases[9]	11.76	14.23	18.94	18.94	15.04	9.92	12.05	16.00	16.00	12.00
and pasture[10]	1.93	1.39	1.66	1.75	2.15	1.68	1.36	1.65	1.61	1.87
or and miscellaneous items[11]	0.67	0.96	1.29	1.20	0.82	0.67	0.96	1.29	1.20	0.75
llaneous items,[12] $/head	15.06	15.06	15.06	15.06	15.06	15.06	15.06	15.06	15.06	15.06
costs,[13] $/head	5.83	7.12	7.71	5.98	4.90	5.83	7.12	7.71	5.98	4.47
eral farm overhead,[14] $/head	6.03	6.20	13.74	13.06	18.09	5.19	7.03	13.74	13.06	17.25
charge,[15] $/head	11.22	9.43	15.86	15.58	19.27	9.66	9.12	15.86	15.09	18.68
al costs, $/head	293.54	297.63	320.97	307.87	323.30	256.89	268.77	290.58	275.29	287.02

Selling price — average of Omaha, Nebraska, market prices for given weight, grade, and sex of cattle sold during the period September 1, 1972 – ry 19, 1973, inclusive.

Purchase price — average of prices for Choice grade steers and heifers, Omaha, Nebraska, September-October 1971.

Feedlot costs — includes depreciation, interest on investment, repairs and maintenance, and electricity for the period cattle were maintained on a -floor type feedlot. Year round capacity feeding was assumed in proportioning these costs.

Corn silage costs — $104.89 per acre to produce and ensile with supplemental urea and limestone and $2.62 per acre interest on operating capital, s per acre.

Intermediate silage costs — $70.48 per acre to produce and ensile with supplemental urea and limestone and $1.96 per acre interest on operating l, 18 tons per acre.

Oat-wheat silage costs — $45.40 per acre to produce and ensile with supplemental urea and limestone and $1.81 per acre interest on operating l, 5.6 tons per acre.

Coastal bermudagrass pasture establishment and maintenance costs, Mississippi Agric. Expt. Sta. Bul. 631, pp. 12-13, revised to reflect 1970-71 costs. ound grazing was assumed in proportioning these costs.

Wheat-rye grass winter grazing costs, $41.06/acre, personal communication with Mr. E. G. Morrison, Supt., Brown Loam Expt. Sta., Raymond, Miss. ound use of the land area for winter grass production was assumed.

Cattle purchase interest costs, 8% annual interest rate on initial purchase cost for the period the cattle were kept.

Feed and pasture interest costs, 5% annual interest rate on the cost of the particular feed from average harvest date to the time the cattle were sold.

Labor and miscellaneous items interest cost, 8% annual interest rate for one-half of the total feeding period.

Miscellaneous items include (dollars per head): transportation—$6.35, insurance—$1.67, veterinary expense—$1.67, fuel—$1.31, insecticide—$0.38, 0.59, death losses—$2.89, and implants—$0.20.

Labor costs: $1.50 per hour.

General farm overhead, $16.75 per acre, "Costs of Producing Upland Cotton in the United States, 1966," p. 12, USDA, ERS.

Land charge: sandy soils, $31.16 per acre, same source as in footnote 14; clay soils, $15.00 per acre.

Appendix Table 22. Net returns by components of production for various systems of finishing steers and heifers, 1969-71.

Components	Steer systems					Heifer systems			
	1	2	3	4	5	1	2	3	4
Net returns to management, $/head	12.43	15.07	15.38	-11.62	- 0.06	12.85	19.91	31.88	- 0.57
Net returns to management, $/acre	27.03	28.87	17.40	-12.63	- 0.06	31.19	40.97	36.64	- 0.77
Net returns to land and management, $/head	26.76	28.65	31.15	4.98	20.23	25.69	30.52	47.25	14.58
Net returns to land and management, $/acre	58.17	54.89	35.24	5.41	19.45	62.35	62.80	54.31	19.44
Net returns to land, labor, and management, $/head	33.65	35.49	37.87	12.16	25.77	32.58	36.22	53.97	21.76
Net returns to land, labor, and management, $/acre	73.15	67.99	42.84	13.22	24.78	79.08	74.53	62.03	29.01
Net returns to land, labor, management, and general farm overhead – $/head	41.35	44.23	50.64	27.62	43.19	45.42	43.36	66.00	35.79
Net returns to land, labor, management, and general farm overhead – $/acre	89.89	84.73	57.29	30.02	41.53	110.24	89.22	85.86	47.72

Appendix Table 23. Net returns by components of production for various systems of finishing steers and heifers, 1970-72.

Item	Steer systems					Heifer systems			
	1	2	3	4	5	1	2	3	4
Net returns to management, $/head	43.25	54.28	36.06	20.19	20.08	27.88	28.49	32.47	15.18
Net returns to management, $/acre	116.89	109.66	42.52	26.19	16.87	79.66	67.04	38.34	20.21
Net returns to land and management, $/head	54.78	66.88	52.34	34.50	42.62	38.79	38.91	48.43	29.03
Net returns to land and management, $/acre	148.05	135.11	61.72	44.75	35.82	110.83	91.55	57.18	38.66
Net returns to land, labor and management, $/head	60.73	73.61	57.60	40.83	47.48	44.74	44.78	53.69	35.36
Net returns to land, labor, and management, $/acre	164.14	148.71	67.92	52.83	38.90	127.83	105.36	63.39	46.95
Net returns to land, labor, management, and general farm overhead – $/head	66.93	81.90	71.80	53.64	67.41	50.60	51.90	67.88	47.84
Net returns to land, labor, management, and general farm overhead – $/acre	180.89	165.45	84.67	69.57	56.65	144.57	122.12	80.14	63.70

pendix Table 24. Net returns by components of production for various systems of finishing steers and heifers, 1971-73.

mponents	Steer systems					Heifer systems				
	1	2	3	4	5	1	2	3	4	5
t returns to management, $/head	50.82	43.93	35.20	51.34	0.56	22.25	32.47	34.03	38.79	13.34
t returns to management, $/acre	141.17	118.73	42.93	65.82	0.52	71.77	90.10	41.05	49.73	12.95
t returns to land and management, /head	62.04	53.36	51.06	66.92	19.83	31.91	41.59	49.89	53.88	32.02
t returns to land and management, /acre	172.33	144.22	62.27	85.79	18.36	102.94	115.53	60.84	69.08	31.09
t returns to land, labor, and anagement, $/head	67.87	60.48	58.77	72.90	24.73	37.74	48.71	57.60	59.86	45.59
t returns to land, labor, and anagement, $/acre	188.53	163.46	71.67	93.46	22.90	121.74	135.31	70.24	76.74	44.26
t returns to land, labor, management, nd general farm overhead – $/head	73.90	66.68	72.51	85.96	42.82	42.93	55.74	71.34	69.91	62.84
t returns to land, labor, management, nd general farm overhead – $/acre	205.28	180.22	88.43	110.21	39.65	138.49	154.83	87.00	89.63	61.01

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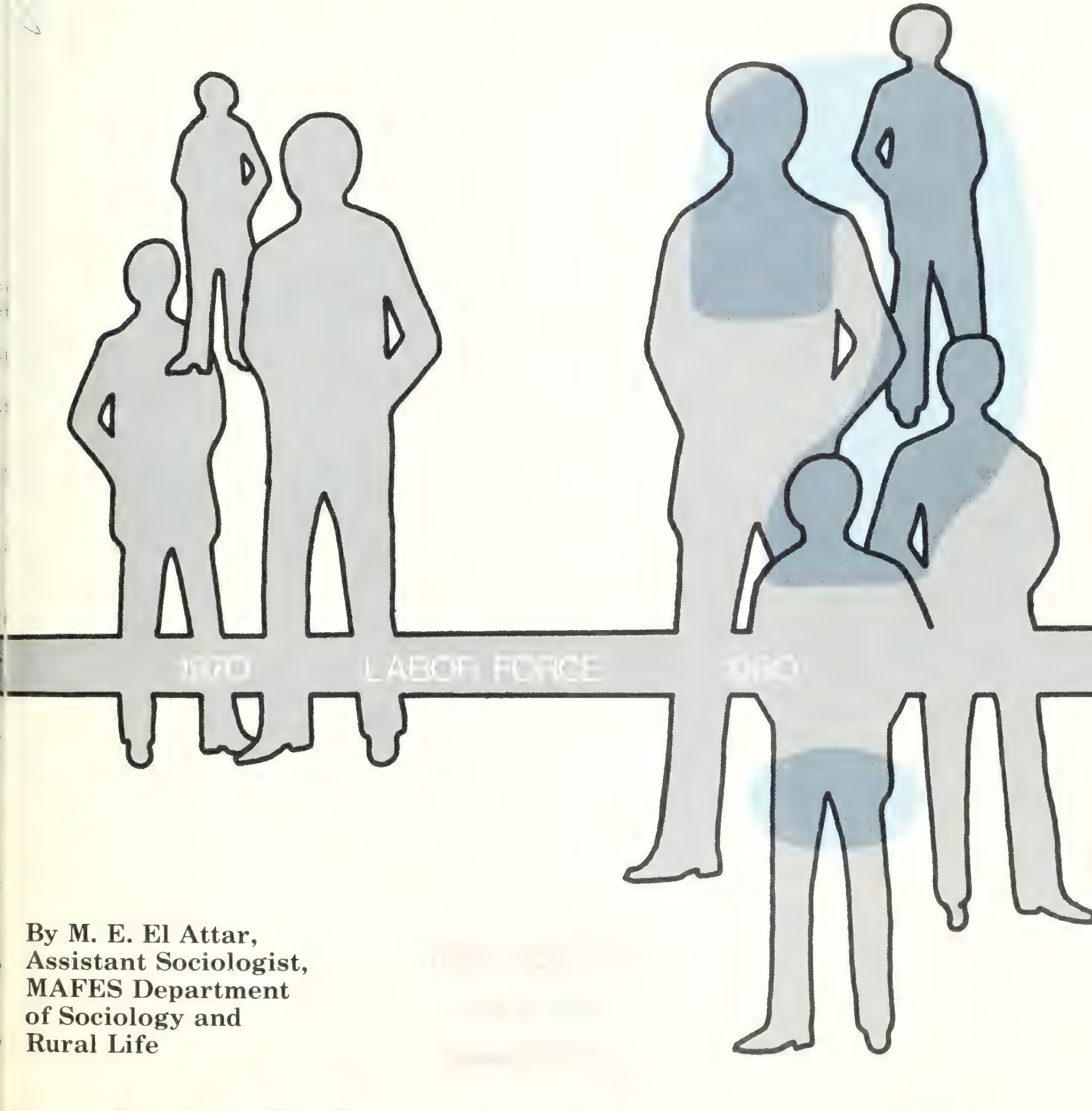
Bulletin 815 March 1975

MISSISSIPPI POPULATION BY COUNTY, AGE, SEX, AND COLOR: 1960,1970 AND PROJECTIONS TO 1980



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Foreword

Population data have been ought and counts of the popula- on made since biblical times. Census" is a Latin word and the ncient Romans regularly counted e inhabitants of that city and its rovinces.

These early censuses had as their rincipal objectives the collection taxes and military conscription, fact which made them widely un- opular and suspect. Today a wide ariety of population data are ystematically gathered not only rough the decennial census but so through surveys and through the registration of births, deaths, and other events.

The uses to which these data can be put are numerous and indispensable to planning. Population data are necessary for estimating school enrollments, future social security payments, a community's tax base, consumer demands for products that are age-related---for instance, those that are consumed by infants---the number of voters in a population, and many others.

The materials presented in this bulletin are part of a research tradition in the Department of Sociology and Rural Life in the Mississippi Agricultural and Forestry Experiment Station---a tradition that dates back into the late 1940's. In providing census data for 1960 and 1970---and projections of these data to 1980---it is hoped that a service has been performed for all those who are concerned with planning the future of the state.

John Saunders, Head
Department of Sociology
and Rural Life

Mississippi Population By County, Age, Sex and Color: 1960, 1970, and Projections to 1980[1]

here is little need to emphasize
importance of population pro-
ions in the search for viable and
ductive development plans of
community. The population
nands include housing, jobs, ser-
es, and communications. Planning in many sectors such as housing, education, employment, production and distribution of goods and services, social security and welfare cannot be carried out rationally without reference to the anticipated size, composition, and distribution of the population. Even the apportionment of members of the U.S. House of Representatives among the states is based on the population size of each state.

Projection Method And Assumptions

opulation projections can be
le with different methods, each
which demands particular data
s, specific computational
niques, and a given set of
nographic assumptions.
hough each method has its
ngths and weaknesses, all
hods have one characteristic in
mon:---the lack of "any
sterious talent for foretelling
future." Each method provides
radiation" to the anticipated
ity, but never the reality itself.
his report uses Hamilton-
ry's method (1962) for projec-
g the 1980 county populations of
sissippi by age, sex, and color.
method is a cohort-survival
hod. Cohort-survival methods
identified with their tendencies
educe biases and distortions in
data and, hence minimize pro-
ion errors (Grauman, 1959;
ver and Black, 1966). Like other
ort-survival methods,
milton-Perry's method assumes
t the age-specific vital and
ration rates which prevailed
ween two censuses will continue throughout the projection period. There is no reason to doubt the general validity of this assumption although migration can be predicted less reliably than can vital rates.

Three primary factors are involved in population projections. These factors are fertility, mortality, and net migration. In 1970, the total fertility rate[2] of Mississippi was 2,936 births per 1,000 women in the childbearing ages (15 to 44), a reduction of about one-third over the 1960 rate of 4,294 per 1,000 women. The total fertility rates among whites dropped from 3,304 in 1960 to 2,300 in 1970, while total fertility rates among nonwhites dropped from 5,882 in 1960 to 4,167 in 1970. Since regional fertility differentials in this country have tended to disappear, it was assumed that the projected age-color fertility rates of each county were the same as that of the state.

The projected age-specific fertility rates employed in estimating the number of births for each color are based on the number of live births occurring in Mississippi in 1970 and the number of women in the childbearing ages (10-49) enumerated in the 1970 census. The 1980 population estimates assume a continuation of the 1970 age-specific fertility rates for white and nonwhite females. Any departure from this assumption will, of course, affect the projected number of people under 10 years of age on April 1, 1980.

Concerning mortality and migration effects, the method used combines the two effects and assumes their constancy over time. This assumption, especially with regard to mortality, is valid since the age-specific mortality rates in this country, by sex and color, change quite slowly. For example, crude death rates in Mississippi were 10.0 per thousand in 1960 and 10.5 per thousand in 1970. It is in the area of migration that the researcher cannot predict changes in direction and magnitude with confidence.

---

[1] The research reported herein was supported by Mississippi Agricultural and Forestry Experiment Station (MAFES), Population Project 4004. A number of persons have contributed their assistance in the preparation of this report. More specifically, credit is due to many persons in the Department of Sociology, the Tramel Computing Center, and the Editorial Department. Mr. D. Steinman diligently assisted in compiling and coding the data, and executing and checking the computations. Mrs. S. El Hakeem, computer programmer at MSU Computing Center, did all the highly complex programming for computing and tabulating the projections. Messrs T. Kight and J. Hedrick contributed helpful editorial assistance. Without the computer time granted and the financial support of MAFES, this effort would not have been possible. The responsibility for any errors is the author's.

[2] The total fertility rate is the total of the age - specific fertility rates of females 15 to 44 years of age by single years of age. The resulting figure is an estimate, the number of births that would occur to 1,000 women throughout their lifetime if the age-specific fertility rates prevailing in a given year were to be maintained for 30 years. See Shryock, Siegel and Associates, 1971, p. 524.

Comparison And Analysis

The number of inhabitants of Mississippi as reported in the 1970 Population Census is 2,216,912. This is 1.1 percent of the Nation's total, whereas the land area of the State (47,296 square miles) is 1.3 percent of the total land area of the United States (U. S. Bureau of the Census, 1972a). The current projections yield an estimated population of 2,320,726 in April of 1980 (Appendix Table 1.). By that time, the United States is expected to have a population of between 222 million and 231 million (U. S. Bureau of the Census, 1972b), depending on the levels of fertility, mortality, and migration.

Moderate population growth is projected for Mississippi (Table A.). A decline is projected for nonwhites, an increase for whites.

The 1980 population projection is for an increase of 4.7 percent (nearly 104,000) over 1970. The estimated relative growth of the national population for the same period ranges between 9.2 and 13.3 percent.

Projections for Counties---Thirty-three counties reported an aggregate population increase of 14.4 percent between 1960 and 1970 (Table B.), and 33 counties are expected to show an aggregate population increase of 18.5 percent by 1980. In contrast to the gaining counties, the losing counties show decreases of 8.9 percent from 1960 to 1970 (slightly over 105,000) and of 9.7 percent from 1970 to 1980 (Table B.).

Table B. Changes in Mississippi Population, By Counties 1960-1980.*

County	Number		Percent	
	1960-70	1970-80	1960-70	1970-80
Gaining Counties	**144,025**	**209,690**	**14.4**	**18.5**
Alcorn	1,897	2,342	7.5	8.6
Choctaw	17	72	0.2	0.9
Clay	L	113	L	0.6
Covington	365	187	2.7	1.3
DeSoto	11,994	40,203	50.2	112.0
Forrest	5,127	5,800	9.7	10.0
George	1,361	765	12.3	6.1
Greene	179	58	2.1	0.7
Grenada	1,445	1,499	7.8	7.6
Hancock	3,348	4,055	23.8	23.3
Harrison	15,093	13,665	12.6	10.2
Hinds	27,928	35,113	14.9	16.3
Itawamba	1,767	2,415	11.7	14.3
Jackson	32,453	49,901	58.5	56.7
Lafayette	2,826	3,417	13.2	14.1
Lamar	1,534	1,480	11.2	9.7
Lawrence	922	1,132	9.0	10.2
Lee	5,559	5,995	13.7	13.0
Lowndes	3,061	3,969	6.6	8.0
Marshall	L	327	L	1.4
Monroe	90	L	0.3	L
Oktibbeha	2,577	4,259	9.8	14.8
Pearl River	5,391	6,970	24.1	25.1
Perry	320	234	3.7	2.6
Pontotoc	131	132	0.8	0.8
Prentiss	2,184	2,303	12.2	11.4
Rankin	9,611	15,616	28.0	35.5
Scott	182	L	0.9	L
Stone	1,088	1,230	15.5	15.2
Tate	406	1,095	2.2	5.9
Tippah	759	509	5.0	3.2
Tishomingo	1,051	1,015	7.6	6.8
Union	192	180	1.0	0.9
Warren	2,775	3,351	6.6	7.4
Wayne	392	288	2.4	1.7

(continued)

Table A. Population, By Color, Mississippi, 1960, 1970 And Projection To 1980, With Comparisons.*

Color	Population			Change	
	1960	1970	1980 (Projection)	1960-70	1970-80
	---Number---			--%--	
White	1,257,546	1,393,283	1,587,724	10.8	14.0
Nonwhites	920,595	823,629	733,002	-10.5	-11.0
Total	2,178,141	2,216,912	2,320,726	1.8	4.7

***Source: Data compiled and computed from the U. S. Bureau of the Census, 1961 Table 27, and 1971 Table 35.**

Projected Labor Force Size---T exact size of the state's labor fo in 1980 is difficult to estimate, si it is influenced by the labor fo participation rates which in t are the outcome of many c plicated factors---including fut size and age-sex structure of projected population, migrati educational attainment, the du tion of the work week and number of weeks of work during year, labor productivity, natio and international economic

TABLE B. (continued)

County	Number		Percent	
	1960-70	1970-80	1960-70	1970-80
osing Counties	**-105,254**	**-105,876**	**-8.9**	**-9.7**
Adams	-437	-1,197	-1.2	-3.2
Amite	-1,810	-1,539	-11.6	-11.2
Attala	-1,765	-1,716	-8.3	-8.8
Benton	-218	-244	-2.8	-3.3
Bolivar	-5,055	-6,273	-9.3	-12.7
Calhoun	-1,318	-1,502	-8.3	-10.3
Carroll	-1,780	-953	-15.9	-10.1
Chickasaw	-86	-454	-0.5	-2.7
Claiborne	-759	-21	-7.0	-0.2
Clarke	-1,444	-1,280	-8.8	-8.5
Clay	-93	G	-0.5	G
Coahoma	-5,765	-6,735	-12.5	-16.7
Copiah	-2,302	-2,457	-8.5	-9.9
Franklin	-1,275	-1,240	-13.7	-15.5
Holmes	-3,976	-3,832	-14.7	-16.6
Humphreys	-4,492	-3,929	-23.5	-26.9
Issaquena	-839	-618	-23.5	-22.6
Jasper	-915	-817	-5.4	-5.1
Jefferson	-847	-694	-8.4	-7.5
Jefferson Davis	-604	-425	-4.5	-3.3
Jones	-3,185	-3,633	-5.3	-6.4
Kemper	-2,044	-1,676	-16.6	-16.4
Lauderdale	-32	-448	0.0	-0.7
Leake	-1,575	-1,316	-8.4	-7.7
Leflore	-5,031	-5,325	-10.7	-12.6
Lincoln	-561	-921	-2.1	-3.5
Madison	-3,167	-1,705	-9.6	-5.7
Marion	-422	-1,102	-1.8	-4.8
Marshall	-476	G	-1.9	G
Monroe	G	-144	G	-0.4
Montgomery	-402	-764	-3.0	-5.9
Neshoba	-125	-63	-0.6	-0.3
Newton	-534	-557	-2.7	-2.9
Noxubee	-2,538	-2,363	-15.1	-16.5
Panola	-1,962	-2,838	-6.8	-10.6
Pike	-3,307	-3,358	-9.4	-10.6
Quitman	-5,131	-4,595	-24.4	-28.9
Scott	G	-304	G	-1.4
Sharkey	-1,801	-1,820	-16.8	-20.4
Simpson	-507	-753	-2.5	-3.8
Smith	-742	-795	-5.2	-5.9
Sunflower	-8,703	-8,214	-19.0	-22.2
Tallahatchie	-4,743	-4,630	-19.7	-23.9
Tunica	-4,972	-4,049	-29.6	-34.2
Walthall	-1,012	-987	-7.5	-7.9
Washington	-8,057	-9,561	-10.2	-13.5
Webster	-533	-499	-5.0	-5.0
Wilkinson	-2,136	-1,688	-16.1	-15.2
Winston	-840	-638	-4.4	-3.5
Yalobusha	-587	-546	-4.7	-4.6
Yazoo	-4,349	-4,658	-13.7	-17.1

G indicates that data for that county are given under Gaining Counties.

L indicates that data for that county are given under Losing Counties.

***Source: Appendix, Table 2.**

political conditions, and technological change. However, an estimate of the size of the labor force by 1980 can be obtained by assuming that the age-sex-specific labor force participation rates observed in 1970 for whites and nonwhites will remain the same through the 1970's. Based on that assumption, for the state as a whole the labor force (composed of persons in ages 15 to 64) would increase by 10.4 percent by 1980 (from 748,646 to 826,381). At the same time remarkable differences among men and women within and between white and nonwhite labor force participation are noticeable (Table C.).

Males have a much higher participation rate than females, but this rate declined from 79.9 percent in 1960 to 74.1 percent in 1970; the anticipated rate for 1980 is 76.3 percent. Correspondingly, women increased their participation rate from 37.6 percent in 1960 to 42.9 percent in 1970. In 1980 the female rate is expected to be 43.6 percent (Table D.).

The decline in the labor force participation rate of Mississippi in 1970 has resulted mainly from a decline in the participation of males among both whites and nonwhites (from 82.2 to 79.0 percent for white and 75.6 to 63.2 percent for nonwhite males in 1960 and 1970, respectively). The estimated percentages for 1980 are 80.7 and 64.8 for whites and nonwhites, respectively. At the same time, while the participation rate for white females (36.5 percent) was smaller than that for nonwhite females (39.2 percent) in 1960, the situation was reversed in 1970 (43.7 and 41.5 percent for whites and non-whites, respectively) and the participation of white females is expected to remain higher until 1980 (44.0 and 42.7 percent). These differences have been the result of educational requirements, technological developments, changes in social and ethnic norms, limitation of family size, and changes in life styles.

Table C. Mississippi Labor Force, 1970 And Projected To 1980.*

Age	White				Non-white				Total			
	Male		Total		Male		Total		Male		Total	
	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980
15-19	24,681	25,716	38,097	39,990	11,085	9,060	17,503	14,379	35,766	34,776	55,600	54,369
20-24	47,222	56,451	77,065	91,493	16,834	18,683	30,240	33,290	64,056	75,134	107,305	124,783
25-29	42,106	55,035	63,046	82,917	13,613	16,866	25,191	31,009	55,719	71,901	88,237	113,926
30-34	38,926	56,282	59,200	85,752	12,218	13,234	22,596	25,132	51,144	69,516	81,796	110,884
35-39	36,156	47,034	56,552	72,650	12,075	11,071	22,444	20,354	48,231	58,105	78,996	93,004
40-44	36,726	40,302	58,351	63,348	11,940	10,113	22,312	18,629	48,666	50,415	80,663	81,977
45-49	34,942	34,384	56,173	55,082	11,478	8,853	21,161	16,495	46,420	43,237	77,334	71,577
50-54	30,594	33,739	49,291	54,185	11,790	9,119	20,785	16,718	42,384	42,858	70,076	70,903
55-59	27,951	28,496	44,269	45,637	11,258	7,816	18,652	13,837	39,209	36,312	62,921	59,474
60-64	20,253	21,344	31,022	33,254	8,893	7,254	14,693	12,230	29,146	28,598	45,715	45,484
Total	339,557	398,783	533,066	624,308	121,184	112,069	215,577	202,073	460,741	510,852	748,643	826,381

*Source: U. S. Bureau of the Census, 1972c, Table 164; and Appendix, Table 1.

TABLE D. LABOR FORCE PARTICIPATION IN MISSISSIPPI BY COLOR AND SEX, 1960-80.

Race	Sex	Labor Force					
		1960		1970		1980	
		No.	Rate	No.	Rate	No.	Rate
White	Male	309,115	82.2	339,557	79.0	398,783	80.7
	Female	139,360	36.5	193,509	43.7	225,525	44.0
	Total	448,475	59.2	533,066	61.1	624,308	61.9
Non-white	Male	157,565	75.6	121,184	63.2	112,069	64.8
	Female	95,401	39.2	94,393	41.5	90,004	42.7
	Total	252,966	56.0	215,577	51.4	202,073	52.7
Total	Male	466,680	79.9	460,741	74.1	510,852	76.3
	Female	234,761	37.6	287,902	42.9	315,529	43.6
	Total	701,441	58.0	748,643	57.9	826,381	59.3

Source: U. S. Bureau of the Census, 1962, Table 115; 1972c, Table 164; and Appendix, Table 1.

APPENDIX

The Appendix Tables compare he population censuses of 1960 nd 1970, and provide population rojections for 1980 for Mississippi ounties by age, sex, and color. Due o lack of space, it is not possible to resent the data in full detail, so hat in Table 1, for example, the total number of females is not given nor is the total population of the state. The reader can, however, arrive at these figures by subtracting white males from total whites to arrive at the number of white females, and proceed likewise with the nonwhite population. State totals for each decade can be obtained by adding the total number of whites and nonwhites. Tables 2 and 3 which contain county data can be handled in a similar fashion.

TABLE 1. POPULATION OF MISSISSIPPI BY AGE, SEX AND COLOR: 1960, 1970, AND PROJECTIONS TO 1980.

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	68028	132612	72691	145800	57531	111724	48688	97882	73833	143991	49056	98436
5- 9	64499	126476	67032	133525	65873	129087	54419	108685	68621	135100	44476	88781
10-14	63954	124613	59340	117244	70338	136757	58559	115670	62159	120602	39823	78826
15-19	56470	107646	44893	89048	67647	132036	50333	100935	71127	139342	41767	83964
20-24	41513	81837	24925	52923	59411	117412	25575	55920	69601	137422	26816	58349
25-29	37132	75538	17659	40240	45200	91135	16573	37022	58738	119890	19649	44412
30-34	39146	80359	16861	40064	40281	81390	14315	33099	59276	120704	15109	35944
35-39	39598	81245	17072	40045	37880	77622	13195	31022	49777	100127	12595	29008
40-44	37490	76804	17889	40644	40058	82045	13754	32908	43391	86749	11849	27595
45-49	37542	76271	20060	43484	38677	79767	13687	31894	38228	78342	10749	25077
50-54	34773	70186	18622	39471	35983	74764	14820	33014	39211	81061	11580	27159
55-59	29032	59669	17296	36162	34106	71472	15376	33314	35415	75364	10619	24721
60-64	23115	48492	12832	27714	30823	65488	15064	32528	32110	70330	12140	27568
65-69	19833	42314	14370	30001	23158	51791	14015	31103	27357	62404	12593	28978
70+	32886	73484	21380	44230	36781	90793	22097	48633	44239	116296	23517	54184
TOTAL	625011	1257546	442922	920595	683747	1393283	390470	823629	773083	1587724	342338	733002

TABLE 2. POPULATION OF MISSISSIPPI BY COUNTY, SEX AND COLOR: 1960, 1970, AND PROJECTIONS TO 1980.

COUNTY	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
ADAMS	9300	19035	8735	18695	9262	19366	8174	17927	8931	19070	7535	17026
ALCORN	10744	21949	1564	3333	11510	23951	1497	3228	12527	26346	1452	3175
AMITE	3550	7130	4160	8443	3371	6814	3387	6949	3239	6591	2738	5633
ATTALA	5816	11789	4619	9546	5694	11632	3860	7938	5591	11451	3132	6403
BENTON	2036	4114	1794	3609	2110	4350	1537	3155	2264	4702	1233	2559
BOLIVAR	8662	17521	17900	36943	9198	18750	14413	30659	9698	19857	10563	23279
CALHOUN	5816	11595	2067	4346	5254	10807	1836	3816	4671	9855	1597	3266
CARROLL	2337	4677	3190	6500	2301	4615	2296	4782	2433	4828	1710	3616
CHICK	5122	10380	3180	6511	5188	10819	2845	5986	5148	10974	2490	5377
CHOCTAW	2915	5903	1210	2520	2985	6069	1109	2371	3101	6330	1001	2182
CLAIB	1293	2600	4002	8245	1240	2536	3433	7550	1204	2478	3379	7587
CLARKE	4932	10001	3131	6492	4702	9631	2606	5418	4532	9353	2129	4416
CLAY	4450	9214	4570	9719	4587	9517	4343	9323	4667	9729	4271	9224
COAHOMA	7174	14630	15018	31582	6876	14232	12220	26215	6436	13524	9176	20188
COPIAH	6395	12992	6790	14059	5900	12298	5904	12451	5398	11475	5035	10817
COVIN	4432	8896	2339	4741	4559	9426	2226	4576	4644	9852	2061	4337
DE SOTO	4677	9248	7251	14643	11425	23235	6121	12650	31686	65669	4936	10419
FORREST	18507	37970	6871	14752	20843	43524	6484	14325	23518	49711	6142	13938
FRANK	2742	5486	1832	3800	2385	4897	1492	3114	2063	4325	1164	2446
GEORGE	4995	9811	637	1287	5548	11007	739	1452	5854	11721	769	1503
GREENE	3273	6443	951	1923	3327	6662	909	1883	3372	6830	822	1773
GREN	4455	9352	4353	9057	5276	11154	4102	8700	6256	13283	3737	8070
HANC	5972	11784	1075	2255	7387	14894	1176	2493	9160	18620	1324	2822
HARR	54685	100233	9317	19256	59025	111061	11475	23521	62637	119699	14025	28548
HINDS	53379	112205	35226	74840	61915	130592	39353	84381	72876	153545	44682	96541
HOLMES	3692	7595	9293	19501	3547	7345	7387	15775	3397	7118	5605	12170
HUMPH	2386	5758	6425	13335	2505	5089	4499	9512	2153	4444	2867	6228
ISSAC	602	1176	1180	2400	533	1033	836	1704	506	987	552	1132
ITAWA	7015	14206	419	874	7766	15882	465	965	8797	18134	539	1128
JACK	22596	44658	5331	10864	36891	73547	7007	14428	59239	118749	9193	19127
JASP	4194	8402	4169	8507	4200	8564	3588	7430	4261	8794	3029	6383
JEFFER	1219	2489	3706	7653	1106	2296	3341	6999	1023	2134	3037	6467
J. DAVIS	3047	6126	3648	7414	3187	6435	3118	6501	3298	6719	2712	5792
JONES	21806	44095	7370	15447	20569	42403	6595	13954	19152	40257	5806	12467
KEMPER	2398	4828	3705	7449	2220	4488	2851	5745	2095	4214	2153	4343
LAFA	7347	14110	3527	7245	8958	17313	3289	6868	10893	21219	3010	6379
LAMAR	5845	11443	1128	2232	6546	13187	973	2022	7203	14847	847	1842
LAUD	20627	43635	10767	23484	22373	46186	9484	20901	24280	48651	8070	17988
LAWR	3199	6354	1902	3861	3711	7553	1728	3584	4369	8988	1556	3281
LEAKE	5269	10559	3981	8101	5118	10452	3251	6633	4968	10300	2672	5469
LEE	14812	30300	4882	10289	17815	36571	4475	9577	21007	43236	4113	8907
LEFLORE	7936	16699	14503	30443	8290	17550	11563	24561	8489	18041	8667	18745

(CONTINUED)

TABLE 2, CONTINUED

COUNTY	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
LINCOLN	9089	18407	3957	8352	8789	18138	3806	8060	8425	17629	3578	7648
LOWNDES	13890	28871	8485	17768	15697	33336	7626	16364	18385	39228	6554	14441
MADISON	4517	9267	11555	23637	5381	11148	8847	18589	6704	13803	6638	14229
MARION	7677	15408	3759	7885	7734	15739	3378	7132	7515	15516	2936	6253
MARSH	3528	7264	8421	17239	4462	9101	7168	14926	5753	11633	6029	12721
MONROE	10690	21932	5690	12021	11460	23650	4914	10393	12035	24992	4196	8907
MONTG	3524	7349	2897	5971	3448	7121	2712	5797	3270	6691	2479	5463
NESHOBA	7328	15026	2862	5901	7319	15091	2685	5711	7338	15141	2569	5598
NEWTON	6347	12950	3140	6567	6495	13352	2623	5631	6661	13696	2130	4730
NOXUBEE	2312	4724	5872	12102	2302	4844	4477	9444	2290	4914	3232	7011
OKTIB	8557	14727	5491	11448	10179	18569	4853	10183	12664	24311	4121	8700
PANOLA	6166	12565	8005	16226	6362	13061	6690	13768	6395	13194	5126	10797
P. RIVER	8642	17221	2483	5190	11261	22688	2457	5114	14661	29700	2436	5072
PERRY	3166	6333	1177	2412	3274	6674	1147	2391	3307	6863	1155	2436
PIKE	9500	19655	7385	15408	8492	17903	6594	13853	7441	15979	5888	12419
PONTO	6876	13946	1642	3286	6898	14254	1496	3109	6949	14504	1382	2991
PRENT	7662	15763	1028	2186	8621	17776	1116	2357	9605	19823	1248	2613
QUIT	3809	7715	6427	13304	3239	6687	4521	9201	2688	5651	2794	5642
RANKIN	10784	21504	6286	12818	15578	31529	6100	12404	23143	47347	5999	12202
SCOTT	6453	13050	3913	8137	6972	14254	3379	7115	7247	15010	2821	6055
SHARK	1607	3247	3563	7491	1523	3125	2787	5812	1428	2979	1982	4138
SIMP	6667	13254	3534	7200	6719	13678	3084	6269	6658	13855	2626	5339
SMITH	5550	11056	1631	3247	5272	10609	1443	2952	5102	10280	1197	2486
STONE	2668	5302	853	1711	3156	6220	952	1881	3714	7262	1051	2069
SUNFLO	7554	14730	15578	31020	6823	13619	11579	23428	6130	12530	7916	16303
TALLAH	4261	8580	7533	15501	3697	7657	5656	11681	3199	6775	3780	7933
TATE	3865	7696	5015	10442	4827	9777	4196	8767	6248	12809	3226	6830
TIPPAH	6004	12337	1382	2756	6430	13260	1314	2592	6815	14018	1188	2343
TISHO	6478	13210	351	679	6972	14268	339	672	7454	15283	328	672
TUNICA	1727	3505	6565	13321	1549	3225	4173	8629	1347	2870	2324	4935
UNION	7713	15592	1624	3312	7809	16145	1392	2951	7897	16607	1223	2669
WALTH	3706	7412	2925	6100	3634	7403	2425	5097	3529	7323	1991	4190
WARREN	10813	22447	9098	19759	12729	26474	8431	18507	14996	31098	7732	17234
WASHIN	17683	35239	20392	43399	15507	31803	18081	38778	13355	28201	15086	32819
WAYNE	5248	10449	2864	5809	5485	11169	2598	5481	5654	11763	2369	5175
WEBSTER	3913	7938	1275	2642	3787	7789	1091	2258	3711	7705	895	1843
WILKIN	1897	3807	4640	9428	1748	3588	3608	7511	1621	3396	2799	6015
WINSTON	5350	10853	4156	8393	5377	11065	3515	7341	5469	11389	2974	6379
YALOB	3410	6962	2717	5540	3376	7071	2297	4844	3387	7221	1923	4148
YAZOO	6231	12862	9033	18791	6161	12690	6933	14614	5857	12085	4887	10561
TOTAL	625011	1257546	442922	920595	683747	1257546	390470	823629	773083	1587724	342338	733002

TABLE 3. POPULATION OF MISSISSIPPI BY AGE, SEX, COLOR AND COUNTY: 1960, 1970, AND PROJECTIONS TO 1980.

1—ADAMS

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	1231	2370	1449	2907	789	1548	876	1847	782	1540	1052	2214
5- 9	1168	2250	1298	2660	976	1996	1137	2243	780	1600	1048	2064
10-14	989	1966	1017	2036	1029	2057	1261	2507	660	1345	762	1592
15-19	642	1337	751	1514	875	1802	1030	2082	731	1605	902	1756
20-24	518	1199	406	991	538	1298	456	1084	560	1360	565	1333
25-29	570	1250	381	926	626	1322	343	843	853	1781	470	1159
30-34	759	1537	406	975	583	1199	268	727	606	1293	301	794
35-39	690	1407	416	947	501	1078	335	810	550	1141	302	738
40-44	607	1257	438	932	691	1389	324	831	531	1084	214	623
45-49	575	1112	435	908	617	1279	339	798	448	981	273	684
50-54	517	1006	426	893	584	1148	377	805	665	1271	279	718
55-59	363	724	357	816	468	941	342	728	502	1085	267	642
60-64	242	527	289	623	404	808	329	740	456	922	291	668
65-69	165	383	271	626	256	583	293	708	330	758	281	630
70+	264	710	395	941	325	918	464	1174	477	1304	528	1411
TOTAL	9300	19035	8735	18695	9262	19366	8174	17927	8931	19070	7535	17026

(CONTINUED)

TABLE 3, CONTINUED

2—ALCORN

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	1027	1946	222	441	962	1946	167	339	1126	2287	208	422
5- 9	1042	2054	225	423	1081	2061	183	373	1153	2204	182	370
10-14	1246	2441	195	380	1120	2192	197	393	1049	2197	148	302
15-19	987	1922	148	285	1004	2043	182	364	1042	2048	148	323
20-24	561	1162	76	190	862	1806	100	221	775	1622	101	229
25-29	529	1154	69	142	776	1635	74	159	789	1744	91	204
30-34	644	1291	49	141	692	1420	49	131	1063	2206	64	151
35-39	681	1444	70	166	629	1308	61	139	923	1856	65	156
40-44	669	1408	61	138	687	1382	50	131	738	1520	50	122
45-49	662	1357	80	175	680	1396	65	153	628	1265	57	128
50-54	624	1320	65	186	666	1381	58	131	684	1356	48	125
55-59	526	1152	76	153	572	1256	59	147	588	1293	48	130
60-64	431	919	74	151	590	1289	67	166	630	1348	60	120
65-69	421	854	60	134	458	1043	68	145	498	1137	53	141
70+	694	1525	94	228	731	1793	117	236	841	2263	129	252
TOTAL	10744	21949	1564	3333	11510	23951	1497	3228	12527	26346	1452	3175

3—AMITE

0- 4	334	614	629	1289	250	468	423	844	298	560	385	767
5- 9	350	696	630	1292	274	531	471	930	286	556	390	768
10-14	367	739	654	1268	337	668	530	1077	252	510	356	705
15-19	299	577	510	954	302	561	452	901	236	428	338	649
20-24	138	299	171	360	167	383	166	365	153	345	135	312
25-29	143	299	125	272	170	365	120	268	172	354	106	256
30-34	176	359	142	337	164	341	106	216	198	435	103	219
35-39	205	421	177	375	183	345	99	231	218	420	95	228
40-44	208	447	147	345	190	376	125	285	177	357	93	183
45-49	238	492	186	352	197	389	139	294	176	320	78	181
50-54	270	504	201	428	195	446	134	296	178	373	114	245
55-59	228	455	173	333	230	455	135	262	190	360	101	220
60-64	190	373	106	218	240	455	152	295	173	404	101	203
65-69	168	314	116	232	178	374	129	276	180	374	101	218
70+	236	541	193	388	294	657	206	409	352	795	242	479
TOTAL	3550	7130	4160	8443	3371	6814	3387	6949	3239	6591	2738	5633

4—ATTALA

0- 4	534	998	684	1378	423	784	500	976	451	839	398	775
5- 9	539	1021	633	1335	480	897	550	997	452	848	419	758
10-14	640	1212	693	1349	570	1075	540	1059	452	845	395	751
15-19	500	957	566	1077	492	939	476	964	438	825	414	725
20-24	222	467	253	545	340	709	211	471	303	629	164	370
25-29	235	515	166	360	322	611	178	347	317	600	150	311
30-34	307	663	151	368	278	559	117	285	426	849	98	248
35-39	336	713	181	433	264	583	120	287	362	691	129	274
40-44	355	768	181	397	341	714	134	312	309	603	104	242
45-49	368	760	209	440	316	697	138	318	248	570	91	210
50-54	373	758	191	425	337	756	147	336	324	702	109	265
55-59	361	701	194	393	361	725	165	342	310	664	109	247
60-64	300	636	131	295	338	729	168	360	305	731	129	284
65-69	286	590	168	313	313	645	169	347	313	668	144	302
70+	460	1030	218	438	519	1209	247	537	581	1387	279	641
TOTAL	5816	11789	4619	9546	5694	11632	3860	7938	5591	11451	3132	6403

(CONTINUED)

TABLE 3, CONTINUED

5—BENTON

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	151	328	346	697	173	343	206	397	209	414	198	382
5- 9	196	396	290	581	194	382	256	520	228	451	157	318
10-14	235	472	249	495	170	379	265	543	195	396	158	309
15-19	201	356	200	367	170	355	186	373	168	342	164	334
20-24	102	197	99	210	138	273	80	166	100	219	85	182
25-29	86	193	64	142	118	239	58	116	100	244	54	119
30-34	120	236	71	180	112	233	52	112	152	324	42	88
35-39	122	251	77	159	96	216	42	109	132	268	38	88
40-44	140	267	62	127	127	244	62	142	119	241	45	89
45-49	133	257	66	130	125	251	58	117	98	215	32	80
50-54	112	240	59	137	132	270	49	96	120	247	49	107
55-59	117	247	66	120	147	272	40	102	138	265	35	92
60-64	92	179	42	66	124	280	47	111	146	314	39	78
65-69	87	181	34	64	117	234	53	100	147	259	32	86
70+	142	314	69	134	167	379	83	151	212	503	105	207
TOTAL	2036	4114	1794	3609	2110	4350	1537	3155	2264	4702	1233	2559
6—BOLIVAR												
0- 4	930	1779	3116	6137	716	1437	2083	4283	880	1773	1510	3100
5- 9	955	1855	2943	5745	842	1636	2237	4436	934	1819	1338	2651
10-14	953	1874	2645	5169	883	1679	2254	4396	680	1356	1507	3067
15-19	803	1656	1850	3562	967	1966	1978	3932	853	1734	1503	3036
20-24	609	1249	798	1672	1188	2298	920	2045	1101	2060	784	1739
25-29	485	967	511	1234	629	1241	476	1128	757	1474	509	1253
30-34	513	1058	524	1314	462	915	377	903	901	1687	435	1112
35-39	549	1142	514	1364	448	921	355	893	581	1182	331	816
40-44	515	1089	605	1442	499	1055	360	981	449	911	259	672
45-49	553	1115	747	1641	515	1068	357	989	420	861	247	647
50-54	516	975	733	1554	467	1004	467	1082	452	972	278	734
55-59	329	703	730	1487	465	964	517	1188	433	924	247	721
60-64	268	608	546	1197	421	844	543	1141	381	876	346	794
65-69	284	593	639	1364	250	584	526	1176	353	799	373	949
70+	400	858	999	2061	446	1138	963	2086	523	1429	896	1988
TOTAL	8662	17521	17900	36943	9198	18750	14413	30659	9698	19857	10563	23279
7—CALHOUN												
0- 4	496	962	371	791	401	809	249	464	334	676	245	455
5- 9	574	1093	315	699	442	848	263	506	376	725	207	398
10-14	690	1254	291	592	467	944	281	605	378	796	189	355
15-19	512	978	219	437	464	864	221	495	357	670	185	358
20-24	271	562	131	287	332	667	133	268	225	508	128	273
25-29	272	595	109	235	304	602	89	172	276	532	90	194
30-34	297	614	86	207	265	546	71	172	325	648	72	159
35-39	292	662	97	193	257	563	77	171	287	569	63	125
40-44	334	673	80	176	296	582	69	157	264	518	57	130
45-49	366	763	83	154	252	597	69	163	222	507	55	147
50-54	381	747	72	152	329	680	73	138	292	588	63	123
55-59	363	704	66	127	345	737	64	134	238	579	53	146
60-64	277	574	35	81	356	721	69	133	307	657	70	122
65-69	251	480	38	79	294	618	45	98	279	651	44	105
70+	440	934	74	136	450	1029	63	140	511	1231	76	176
TOTAL	5816	11595	2067	4346	5254	10807	1836	3816	4671	9855	1597	3266

(CONTINUED)

8—CARROLL

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	184	367	478	970	169	321	272	554	229	438	257	523
5- 9	210	397	509	979	196	345	308	672	262	461	234	510
10-14	261	490	473	957	232	436	344	690	213	382	196	394
15-19	230	412	411	804	205	375	317	636	191	326	192	439
20-24	93	190	166	344	135	279	126	283	120	248	92	204
25-29	90	188	87	201	128	257	120	228	114	234	93	181
30-34	104	214	89	223	115	234	68	157	167	344	52	131
35-39	108	239	88	238	120	237	77	169	171	325	106	193
40-44	147	303	139	290	116	250	46	145	128	273	35	101
45-49	179	350	138	288	132	282	82	181	147	281	72	133
50-54	167	353	133	249	142	297	103	216	112	245	34	108
55-59	136	276	124	241	165	338	104	202	122	274	62	127
60-64	112	234	79	154	149	319	86	172	127	269	67	151
65-69	116	235	88	193	117	224	89	173	142	274	75	145
70+	200	429	188	369	180	421	154	304	188	454	143	276
TOTAL	2337	4677	3190	6500	2301	4615	2296	4782	2433	4828	1710	3616

9—CHICKASAW

0- 4	535	1014	488	981	418	822	362	758	434	857	325	679
5- 9	494	968	452	850	507	1021	373	767	417	842	312	641
10-14	570	1092	398	806	530	1029	410	803	414	835	304	620
15-19	401	790	342	697	469	938	360	694	481	990	297	628
20-24	306	643	226	466	354	735	181	407	329	693	186	404
25-29	283	567	130	272	329	659	126	290	385	783	133	287
30-34	276	601	122	252	322	633	127	272	373	725	102	239
35-39	311	597	97	235	288	578	102	230	335	672	99	247
40-44	306	648	113	262	271	601	105	237	316	632	109	256
45-49	322	649	158	315	300	601	99	219	278	583	104	215
50-54	296	616	112	258	292	624	100	228	259	579	93	206
55-59	271	559	122	256	275	612	111	218	256	566	70	152
60-64	199	424	107	219	260	564	106	222	256	571	95	197
65-69	207	435	125	248	220	501	103	249	223	552	94	211
70+	345	777	188	394	353	901	180	392	392	1094	167	395
TOTAL	5122	10380	3180	6511	5188	10819	2845	5986	5148	10974	2490	5377

10—CHOCTAW

0- 4	251	452	197	396	228	427	149	301	274	515	159	321
5- 9	250	497	205	407	265	508	152	324	261	502	127	271
10-14	331	642	173	331	316	564	173	340	287	533	131	259
15-19	253	519	115	251	281	524	135	280	298	537	100	223
20-24	153	287	61	135	184	377	73	164	176	330	73	169
25-29	112	245	45	114	160	331	40	96	178	334	47	107
30-34	123	257	44	91	150	314	43	101	180	416	51	122
35-39	147	327	30	76	132	293	38	88	189	396	34	75
40-44	150	332	37	85	172	333	41	82	210	407	40	91
45-49	201	401	55	115	161	341	19	61	145	306	24	70
50-54	177	366	49	118	150	335	43	83	172	336	48	82
55-59	184	370	52	113	180	378	41	101	144	322	14	56
60-64	151	313	34	70	177	362	57	122	150	331	50	88
65-69	169	350	35	73	154	368	41	94	151	379	32	84
70+	263	545	78	145	275	614	64	134	286	686	71	164
TOTAL	2915	5903	1210	2520	2985	6069	1109	2371	3101	6330	1001	2182

(CONTINUED)

11—CLAIBORNE

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	119	230	600	1166	96	177	339	680	101	187	613	1229
5- 9	118	242	562	1092	94	193	424	826	94	194	587	1141
10-14	143	264	454	883	117	220	515	979	94	169	291	571
15-19	79	152	452	895	114	227	478	1152	91	181	361	872
20-24	61	119	388	831	71	149	353	903	58	124	400	995
25-29	68	144	160	333	77	137	111	265	111	204	117	351
30-34	66	145	130	302	68	135	114	270	79	169	104	298
35-39	75	146	142	343	63	134	116	234	71	127	80	185
40-44	91	196	157	379	81	156	109	237	83	147	96	212
45-49	95	171	182	396	68	140	108	292	57	129	88	196
50-54	83	183	169	363	93	201	146	322	83	160	101	202
55-59	88	169	159	323	76	148	165	339	54	122	98	248
60-64	64	141	117	229	76	165	146	325	85	181	126	288
65-69	54	110	135	270	63	130	120	273	54	114	125	287
70+	89	188	195	440	83	224	189	453	89	270	192	512
TOTAL	1293	2600	4002	8245	1240	2536	3433	7550	1204	2478	3379	7587

12—CLARKE

0- 4	486	949	441	930	346	703	313	615	375	765	269	527
5- 9	499	988	461	942	404	802	305	627	401	800	253	519
10-14	554	1076	462	887	472	910	367	742	336	674	260	492
15-19	415	792	354	654	450	841	329	654	364	682	218	436
20-24	257	524	156	330	299	623	155	341	255	527	123	287
25-29	237	502	111	283	281	591	128	233	305	627	119	233
30-34	299	587	113	260	281	557	83	192	327	662	82	199
35-39	280	573	117	240	254	520	83	192	301	612	96	163
40-44	230	537	118	277	274	540	80	208	258	513	59	154
45-49	303	624	132	310	268	533	105	202	243	484	74	160
50-54	306	620	139	289	244	541	117	242	291	548	79	180
55-59	263	544	150	307	287	604	108	256	254	516	86	167
60-64	210	465	113	230	277	551	113	237	221	480	95	198
65-69	216	441	110	221	199	473	120	275	217	526	86	232
70+	377	779	154	332	366	842	200	402	384	937	230	469
TOTAL	4932	10001	3131	6492	4702	9631	2606	5418	4532	9353	2129	4416

13—CLAY

0- 4	531	1082	688	1463	366	689	516	1030	445	842	719	1434
5- 9	477	941	696	1404	450	873	563	1156	384	746	614	1258
10-14	446	885	655	1307	478	917	608	1289	329	586	456	908
15-19	324	665	490	948	410	815	685	1361	387	756	554	1120
20-24	266	585	295	604	308	676	358	765	330	698	332	757
25-29	325	627	184	448	301	624	158	365	381	765	221	527
30-34	288	579	170	417	272	532	176	370	315	615	214	470
35-39	282	561	168	402	265	534	142	368	245	533	122	299
40-44	273	579	178	427	281	569	137	349	265	522	142	309
45-49	279	576	182	411	285	582	164	374	268	554	139	342
50-54	248	494	175	374	268	587	158	362	276	576	122	296
55-59	189	426	163	352	260	559	142	352	266	565	128	321
60-64	164	340	117	258	229	478	147	325	247	570	133	315
65-69	133	313	156	354	137	343	145	335	188	448	126	337
70+	225	561	253	550	277	739	244	522	341	953	249	531
TOTAL	4450	9214	4570	9719	4587	9517	4343	9323	4667	9729	4271	9224

(CONTINUED)

14—COAHOMA

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	840	1630	2588	5195	597	1122	1638	3263	626	1181	1387	2759
5- 9	863	1642	2261	4589	758	1438	1824	3685	553	1052	1105	2230
10-14	790	1474	1984	3901	762	1422	1892	3802	542	981	1197	2388
15-19	496	1014	1458	2895	626	1251	1646	3270	550	1096	1328	2626
20-24	344	755	749	1611	421	895	647	1463	406	863	617	1430
25-29	405	883	460	1152	402	904	379	933	507	1113	428	1054
30-34	460	1010	493	1260	406	811	338	872	497	964	292	798
35-39	539	1025	532	1259	369	778	321	819	366	796	264	663
40-44	439	888	564	1360	442	919	355	916	390	741	243	634
45-49	426	900	699	1556	439	874	357	885	301	667	215	577
50-54	420	864	668	1517	394	797	461	1062	397	825	290	714
55-59	344	693	643	1341	355	795	521	1146	366	770	266	651
60-64	259	563	476	1059	325	689	540	1174	305	635	373	822
65-69	212	478	597	1183	221	523	515	1145	228	609	417	981
70+	337	811	846	1704	359	1014	786	1780	402	1231	754	1861
TOTAL	7174	14630	15018	31582	6876	14232	12220	26215	6436	13524	9176	20188

15—COPIAH

0- 4	606	1174	1067	2150	418	800	651	1298	484	930	690	1373
5- 9	580	1122	1042	2118	493	973	830	1661	417	825	698	1396
10-14	620	1214	915	1829	611	1184	893	1778	421	806	545	1074
15-19	609	1148	725	1371	647	1261	803	1597	550	1094	640	1253
20-24	391	708	368	774	360	698	378	801	355	681	369	779
25-29	304	640	303	622	310	641	229	537	329	706	254	633
30-34	326	698	239	567	295	608	204	486	272	606	210	504
35-39	358	790	256	569	318	664	216	469	324	665	163	407
40-44	365	758	256	591	340	727	206	460	308	634	176	394
45-49	367	771	341	705	343	713	207	487	305	601	175	401
50-54	389	800	277	593	332	702	234	520	309	673	188	405
55-59	379	775	287	598	323	700	258	553	302	647	157	384
60-64	271	603	190	431	313	718	243	521	267	632	205	457
65-69	306	642	196	413	313	696	232	532	267	632	209	494
70+	524	1149	328	728	484	1213	320	751	488	1343	356	863
TOTAL	6395	12992	6790	14059	5900	12298	5904	12451	5398	11475	5035	10817

16—COVINGTON

0- 4	426	874	365	727	499	862	287	567	500	868	302	597
5- 9	451	871	392	741	387	861	314	606	377	840	281	543
10-14	460	907	331	670	432	893	349	686	506	880	274	535
15-19	423	814	249	511	459	842	318	582	394	826	255	476
20-24	277	505	122	262	250	533	136	314	235	527	143	320
25-29	201	418	84	178	328	666	94	213	356	687	120	240
30-34	224	469	84	201	275	531	76	178	248	566	85	215
35-39	265	527	83	190	214	469	81	181	349	746	91	218
40-44	241	510	90	179	244	536	72	200	300	605	65	177
45-49	298	599	86	186	266	549	88	180	215	490	86	172
50-54	313	578	101	202	210	460	73	151	213	484	58	170
55-59	245	483	86	169	290	567	61	146	259	519	62	140
60-64	166	378	56	136	265	515	75	160	178	414	54	120
65-69	156	363	69	140	163	356	77	162	193	418	55	142
70+	286	600	141	249	277	786	125	250	321	982	130	272
TOTAL	4432	8896	2339	4741	4559	9426	2226	4576	4644	9852	2061	4337

(CONTINUED)

17—DE SOTO

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	492	984	1240	2542	1218	2398	836	1705	3925	7757	761	1551
5- 9	548	1016	1168	2265	1425	2894	881	1838	4303	8768	612	1276
10-14	567	1044	1008	1949	1241	2521	941	1896	3072	6142	634	1271
15-19	393	756	719	1423	964	1908	806	1586	2507	5470	608	1288
20-24	238	479	434	835	645	1569	400	866	1412	3891	373	846
25-29	240	508	270	614	1032	2214	245	540	2531	5605	275	602
30-34	273	557	271	582	971	1910	251	489	2631	6231	231	508
35-39	285	587	252	568	821	1589	166	392	3530	6917	151	345
40-44	298	601	286	624	719	1301	194	422	2557	4481	180	354
45-49	297	566	302	620	548	1118	190	439	1579	3029	125	303
50-54	251	497	261	541	471	937	221	482	1136	2031	150	326
55-59	205	424	271	541	414	814	241	470	764	1612	152	331
60-64	189	352	209	407	341	688	214	447	640	1297	181	398
65-69	140	317	211	435	258	522	207	400	521	1003	184	348
70+	261	560	349	697	357	852	328	678	578	1435	319	672
TOTAL	4677	9248	7251	14643	11425	23235	6121	12650	31686	65669	4936	10419

18—FORREST

0- 4	1968	3904	1040	2139	1737	3375	767	1553	2487	4852	896	1811
5- 9	1909	3646	967	1948	1826	3671	821	1744	2180	4396	790	1677
10-14	1769	3478	846	1699	1903	3719	898	1845	1680	3216	662	1339
15-19	1703	3601	641	1305	2237	4768	805	1647	2140	4828	683	1475
20-24	1890	3524	376	785	3010	6001	458	1040	3238	6416	486	1132
25-29	1186	2333	286	662	1450	2856	292	713	1905	3780	367	901
30-34	1149	2471	286	716	1099	2201	253	628	1750	3767	308	842
35-39	1147	2439	360	870	1061	2184	224	552	1297	2674	229	596
40-44	1106	2307	342	761	1080	2369	263	648	1033	2107	233	569
45-49	1106	2248	324	805	1080	2350	277	642	999	2103	172	407
50-54	933	1939	300	714	1045	2159	300	670	1019	2217	231	571
55-59	746	1639	298	658	937	2069	271	624	915	2174	232	500
60-64	568	1307	231	515	825	1806	237	607	924	2010	237	568
65-69	487	1149	268	545	613	1441	269	600	770	1820	245	570
70+	838	1985	306	630	940	2555	349	812	1181	3351	371	980
TOTAL	18507	37970	6871	14752	20843	43524	6484	14325	23518	49711	6142	13938

19—FRANKLIN

0- 4	271	523	294	610	156	281	154	292	176	320	162	308
5- 9	261	529	272	538	194	378	173	354	175	341	127	259
10-14	261	505	233	437	236	484	242	482	136	259	127	232
15-19	230	462	152	325	244	464	205	404	181	332	130	265
20-24	153	298	99	211	121	244	76	152	109	234	79	168
25-29	131	272	74	167	115	264	55	116	122	263	74	144
30-34	152	308	79	168	113	230	46	113	89	188	35	80
35-39	163	332	80	170	120	255	48	118	105	248	36	82
40-44	145	314	65	155	143	295	52	128	106	220	30	87
45-49	168	346	76	166	157	323	71	134	116	249	43	92
50-54	180	357	87	173	145	309	60	128	143	291	48	105
55-59	171	313	72	159	167	316	58	133	156	295	54	106
60-64	126	279	77	145	153	318	70	150	123	276	48	111
65-69	133	245	67	157	124	280	62	144	121	285	50	121
70+	197	403	105	219	197	456	120	266	205	524	121	286
TOTAL	2742	5486	1832	3800	2385	4897	1492	3114	2063	4325	1164	2446

(CONTINUED)

20—GEORGE

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	650	1253	124	227	557	1080	89	163	531	1034	98	180
5- 9	557	1080	105	185	608	1191	119	229	487	956	94	181
10-14	584	1146	67	153	667	1285	122	222	572	1108	88	160
15-19	490	937	56	125	514	971	96	171	561	1070	109	212
20-24	287	594	33	83	351	794	34	85	401	888	62	121
25-29	274	539	31	65	378	745	27	66	397	772	46	88
30-34	276	577	36	70	353	694	29	70	432	924	30	72
35-39	301	616	22	52	281	568	34	69	388	785	30	70
40-44	275	554	17	46	319	601	38	68	408	727	31	67
45-49	285	525	31	56	273	586	23	52	255	540	36	70
50-54	270	528	25	57	278	561	18	43	322	608	40	66
55-59	203	415	24	43	259	492	24	39	248	552	18	35
60-64	182	352	14	30	253	486	32	64	260	516	23	48
65-69	150	272	12	26	168	366	20	44	214	432	20	39
70+	211	423	40	69	289	587	34	67	378	809	44	94
TOTAL	4995	9811	637	1287	5548	11007	739	1452	5854	11721	769	1503

21—GREENE

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	382	714	167	316	314	626	93	203	307	615	89	193
5- 9	362	702	147	279	332	639	112	236	323	625	100	209
10-14	399	784	124	261	403	747	142	266	331	654	79	171
15-19	357	647	89	185	318	621	138	264	292	566	105	223
20-24	189	367	55	102	250	502	64	124	253	478	73	127
25-29	137	312	36	77	206	410	34	81	183	396	53	115
30-34	164	313	37	75	189	370	27	64	250	506	31	78
35-39	155	334	42	92	160	351	22	49	241	464	21	52
40-44	168	360	30	84	174	337	32	77	201	399	23	67
45-49	182	388	30	64	180	359	36	77	186	377	19	41
50-54	172	340	53	79	149	324	45	98	154	303	48	92
55-59	166	337	26	73	163	339	33	68	161	314	40	82
60-64	131	244	29	66	149	303	42	72	129	289	36	97
65-69	118	236	40	80	131	286	27	64	129	289	34	62
70+	191	365	46	90	209	448	62	140	232	555	71	164
TOTAL	3273	6443	951	1923	3327	6662	909	1883	3372	6830	822	1773

22—GRENADA

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	451	939	686	1398	448	868	533	1078	590	1148	536	1083
5- 9	477	973	613	1254	484	958	629	1193	526	1043	500	948
10-14	452	911	537	1039	501	1007	585	1185	498	933	455	914
15-19	293	638	464	912	445	957	474	967	452	941	486	920
20-24	229	501	243	504	363	778	251	554	402	859	273	635
25-29	275	564	147	387	335	707	184	427	509	1061	188	455
30-34	295	658	162	396	345	668	150	348	547	1040	155	385
35-39	336	703	175	406	292	605	131	321	356	759	164	356
40-44	334	656	183	389	309	688	144	341	361	698	133	300
45-49	290	610	218	446	359	745	126	314	312	641	94	249
50-54	260	536	174	386	329	688	159	355	304	727	125	312
55-59	240	437	196	384	295	635	159	350	365	775	92	249
60-64	149	346	123	284	271	577	146	328	343	741	133	301
65-69	141	302	165	338	188	395	194	372	231	588	157	338
70+	233	578	267	534	312	878	237	567	460	1329	246	625
TOTAL	4455	9352	4353	9057	5276	11154	4102	8700	6256	13283	3737	8070

(CONTINUED)

23—HANCOCK

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	705	1324	153	324	705	1393	141	294	837	1661	220	457
5- 9	651	1286	162	331	773	1550	153	313	807	1622	167	340
10-14	716	1304	125	255	820	1588	163	334	820	1674	150	303
15-19	486	946	97	189	709	1351	151	296	842	1628	143	280
20-24	254	536	47	112	505	1025	68	163	578	1257	89	214
25-29	306	587	47	100	423	888	56	105	617	1266	87	164
30-34	321	655	55	119	428	828	43	103	851	1589	62	150
35-39	340	726	45	97	370	723	41	91	511	1095	49	95
40-44	341	649	55	111	467	883	49	117	623	1121	38	102
45-49	352	721	51	105	397	871	53	107	432	865	48	100
50-54	319	645	52	103	396	798	50	106	542	1085	45	113
55-59	256	565	41	96	382	786	57	106	431	950	59	108
60-64	277	554	42	88	330	719	42	99	410	890	40	103
65-69	257	527	39	89	285	598	39	93	425	834	54	102
70+	391	759	64	136	397	893	70	166	434	1083	73	191
TOTAL	5972	11784	1075	2255	7387	14894	1176	2493	9160	18620	1324	2822

24—HARRISON

0- 4	6878	13298	1665	3315	4703	9228	1446	2922	4909	9674	1938	3912
5- 9	5137	10171	1257	2518	5633	10993	1528	3085	3982	7795	1603	3233
10-14	4365	8358	971	1955	5935	11376	1605	3135	4058	7893	1394	2763
15-19	7819	11139	740	1475	7281	12488	1364	2598	7984	13528	1658	3182
20-24	5724	9512	710	1391	9292	14380	1099	1980	12634	19567	1817	3187
25-29	4375	7908	590	1260	3624	7173	632	1395	3375	8941	1165	2446
30-34	3598	6895	557	1238	3236	6518	605	1315	5253	9661	936	1855
35-39	3436	6697	543	1164	3424	6488	507	1104	2836	5914	543	1223
40-44	2847	5380	487	1026	3108	6154	482	1126	2795	5827	524	1195
45-49	2243	4443	463	965	2988	5976	472	970	2978	5785	441	920
50-54	1882	3907	372	793	2555	4916	418	910	2789	5628	414	1002
55-59	1674	3390	281	646	2047	4070	392	824	2727	5475	400	829
60-64	1652	3115	200	476	1698	3612	309	686	2305	4537	347	788
65-69	1375	2476	182	397	1231	2781	229	570	1505	3332	319	723
70+	1680	3544	299	637	2270	4908	387	901	2507	6142	526	1290
TOTAL	54685	100233	9317	19256	59025	111061	11475	23521	62637	119699	14025	28548

25—HINDS

0- 4	6544	12796	5810	11748	5184	10004	4939	9797	7638	14802	7179	14223
5- 9	5947	11809	5086	10287	5975	11711	5614	11180	6491	12761	6146	12227
10-14	5034	9954	4307	8589	6658	12887	5593	11202	5274	10076	4755	9344
15-19	3603	8033	3310	6823	5997	12291	4845	10180	6025	12184	5348	11057
20-24	3615	8271	2416	5439	4953	11201	3208	7347	6551	14461	4166	9588
25-29	3802	8095	1843	4244	4471	9332	2085	4721	7442	14348	3052	7055
30-34	4325	9142	1711	4133	4040	8357	1696	4110	5535	11328	2252	5557
35-39	4305	8827	1632	3779	3820	8030	1520	3651	4492	9259	1720	4060
40-44	3606	7340	1578	3553	4131	8913	1581	3753	3859	8145	1567	3732
45-49	3208	6628	1712	3725	4066	8455	1454	3333	3608	7694	1354	3219
50-54	2794	5894	1462	3113	3437	7148	1388	3172	3937	8690	1391	3353
55-59	2120	4588	1279	2755	2864	6170	1413	3007	3630	7873	1200	2688
60-64	1604	3533	871	1927	2346	5389	1323	2844	2886	6529	1256	2900
65-69	1134	2670	954	1999	1653	4013	1090	2512	2233	5394	1204	2740
70+	1738	4625	1255	2726	2320	6691	1604	3572	3275	10001	2092	4798
TOTAL	53379	112205	35226	74840	61915	130592	39353	84381	72876	153545	44682	96541

(CONTINUED)

26—HOLMES

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	314	612	1406	2846	239	459	959	1868	318	614	789	1535
5- 9	355	671	1401	2825	292	562	1056	2081	314	607	715	1408
10-14	360	711	1418	2734	293	586	1098	2251	223	439	749	1477
15-19	386	721	1036	2110	524	961	987	1967	431	804	744	1449
20-24	223	391	381	860	268	514	370	846	218	423	287	704
25-29	137	317	273	645	181	377	239	562	246	502	228	523
30-34	202	412	291	712	158	321	191	482	190	429	185	474
35-39	190	412	284	718	139	303	196	495	184	363	172	432
40-44	192	449	356	808	192	383	260	646	150	298	171	438
45-49	250	523	376	880	194	428	243	561	142	315	168	387
50-54	250	494	393	840	176	400	273	662	176	342	199	531
55-59	218	446	391	845	230	497	295	659	178	407	191	421
60-64	155	352	315	667	217	446	318	740	153	363	221	588
65-69	158	380	411	835	157	352	353	736	166	394	266	573
70+	302	704	561	1176	287	756	549	1219	308	818	520	1230
TOTAL	3692	7595	9293	19501	3547	7345	7387	15775	3397	7118	5605	12170

27—HUMPHREYS

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	303	566	1186	2365	239	442	623	1264	206	382	401	812
5- 9	316	625	1039	2080	240	453	670	1319	202	383	346	680
10-14	328	644	936	1828	261	490	738	1457	206	383	388	779
15-19	270	518	650	1341	221	458	614	1207	168	331	396	766
20-24	141	288	316	668	146	335	241	529	116	253	190	422
25-29	151	308	198	476	169	298	151	350	138	261	143	314
30-34	160	322	182	495	140	304	138	315	145	356	105	250
35-39	161	337	200	506	129	259	119	304	144	251	91	223
40-44	154	350	234	529	140	289	117	324	123	274	89	206
45-49	177	368	285	617	152	298	123	319	122	230	73	191
50-54	206	395	253	542	111	288	175	393	101	236	87	240
55-59	161	315	246	492	154	302	171	380	132	245	74	197
60-64	94	191	184	376	145	305	177	390	78	228	122	283
65-69	97	200	219	423	110	236	153	369	105	226	106	290
70+	167	331	297	597	148	332	289	592	167	405	256	575
TOTAL	2886	5758	6425	13335	2505	5089	4499	9512	2153	4444	2867	6228

28—ISSAQUENA

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	55	103	199	387	49	92	111	221	52	96	75	150
5- 9	62	120	153	309	54	97	124	266	55	98	62	132
10-14	79	162	177	326	47	85	132	238	42	76	74	136
15-19	68	133	115	258	63	108	110	195	55	88	89	166
20-24	25	49	77	147	27	64	37	70	16	33	28	51
25-29	18	34	46	87	34	69	29	76	32	56	28	56
30-34	27	70	26	68	29	58	36	74	31	76	17	35
35-39	38	76	27	75	26	53	29	58	49	108	18	51
40-44	45	82	34	87	27	46	20	43	29	42	28	49
45-49	36	80	47	96	35	72	22	52	24	50	24	42
50-54	51	84	49	111	38	72	28	67	23	40	16	33
55-59	27	59	71	125	27	61	33	70	26	55	15	38
60-64	29	45	35	77	30	54	34	75	22	47	19	45
65-69	15	29	44	91	16	39	40	77	16	40	19	44
70+	27	50	80	156	31	63	51	122	34	82	40	104
TOTAL	602	1176	1180	2400	533	1033	836	1704	506	987	552	1132

(CONTINUED)

29—ITAWAMBA

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	642	1272	52	111	628	1322	38	86	839	1776	68	151
5- 9	712	1375	62	108	770	1474	43	90	919	1765	56	118
10-14	747	1481	42	86	725	1456	60	111	709	1514	44	85
15-19	686	1342	43	91	762	1479	63	106	824	1585	44	88
20-24	463	878	24	52	551	1136	30	69	535	1118	43	88
25-29	329	711	22	46	482	1016	26	61	535	1119	38	69
30-34	412	819	20	47	482	945	25	46	574	1227	31	60
35-39	447	905	25	56	398	794	18	37	583	1137	21	49
40-44	392	868	18	44	443	880	21	51	518	1015	26	49
45-49	429	915	21	50	446	918	18	46	397	805	13	30
50-54	413	829	24	46	408	865	19	41	461	881	22	47
55-59	311	659	9	23	406	911	30	58	422	912	26	53
60-64	306	618	15	34	393	795	31	59	388	830	25	53
65-69	265	556	17	39	308	659	13	38	402	911	43	93
70+	461	978	25	41	564	1232	30	66	691	1539	39	95
TOTAL	7015	14206	419	874	7766	15882	465	965	8797	18134	539	1128

30—JACKSON

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	3167	6157	989	1941	4176	8098	998	1962	6706	13057	1487	2919
5- 9	2668	5184	746	1519	4505	8867	1029	2024	5919	11683	1212	2382
10-14	2438	4690	584	1218	4337	8396	1042	2061	5719	11043	1051	2083
15-19	1749	3610	458	901	3145	6349	745	1516	5310	10865	1028	2020
20-24	1427	3025	398	801	2787	6077	495	1109	4958	10888	883	1870
25-29	1564	3142	313	691	3003	5972	436	945	5400	10512	709	1595
30-34	1590	3163	273	622	2616	5224	396	848	5109	10478	493	1182
35-39	1498	3049	295	603	2338	4529	324	696	4489	8611	451	952
40-44	1392	2792	295	601	2217	4283	300	665	3648	7073	435	908
45-49	1445	2725	244	498	1952	3914	261	553	3047	5819	287	640
50-54	1065	1991	210	389	1699	3328	282	567	2706	5110	287	627
55-59	859	1611	178	338	1484	2869	209	445	2005	4128	224	495
60-64	560	1109	101	224	1019	2037	190	368	1626	3417	255	538
65-69	482	953	107	210	709	1424	135	278	1225	2542	159	370
70+	692	1457	140	308	904	2180	165	391	1372	3523	232	546
TOTAL	22596	44658	5331	10864	36891	73547	7007	14428	59239	118749	9193	19127

31—JASPER

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	362	708	624	1303	313	598	428	840	388	745	411	807
5- 9	397	772	647	1249	379	738	473	965	375	732	382	779
10-14	433	818	587	1163	419	816	548	1081	362	689	376	699
15-19	364	700	505	991	379	735	497	943	362	703	363	728
20-24	199	415	267	510	261	525	225	458	253	525	210	426
25-29	234	467	168	374	246	510	143	330	256	536	141	313
30-34	239	510	167	358	242	490	143	320	317	620	121	291
35-39	260	523	154	349	229	478	124	261	241	523	106	230
40-44	269	524	176	347	253	542	123	288	256	520	105	258
45-49	248	525	163	381	256	515	137	303	225	470	110	227
50-54	271	514	146	309	243	493	141	292	229	512	99	245
55-59	220	458	132	286	231	507	155	329	238	496	130	262
60-64	220	453	97	215	231	458	122	280	207	441	118	264
65-69	175	355	130	259	180	408	108	256	189	453	127	294
70+	303	660	206	413	338	751	221	484	363	829	230	560
TOTAL	4194	8402	4169	8507	4200	8564	3588	7430	4261	8794	3029	6383

(CONTINUED)

32—JEFFERSON

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	100	192	607	1224	76	143	375	738	102	193	470	924
5- 9	117	227	556	1112	93	164	442	907	89	157	439	899
10-14	101	208	478	929	103	207	551	1074	78	154	340	648
15-19	87	174	393	749	105	212	474	927	83	152	377	756
20-24	51	106	191	404	68	134	196	411	69	133	226	475
25-29	51	109	142	296	51	90	113	277	62	110	136	345
30-34	76	139	110	277	50	116	111	276	67	146	114	281
35-39	65	137	137	303	56	116	100	234	56	96	80	223
40-44	68	133	135	302	62	121	105	255	41	103	106	254
45-49	84	172	151	330	58	133	119	275	50	112	87	213
50-54	95	200	168	345	65	127	138	273	59	115	107	228
55-59	72	143	137	297	75	158	134	271	52	123	106	225
60-64	65	132	134	296	89	182	131	270	61	116	108	214
65-69	57	137	133	312	55	130	122	294	57	145	119	266
70+	130	280	234	477	100	263	230	517	97	279	222	516
TOTAL	1219	2489	3706	7653	1106	2296	3341	6999	1023	2134	3037	6467

33—JEFFERSON DAVIS

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	286	588	530	1063	277	526	353	734	310	591	366	760
5- 9	332	617	565	1069	316	573	372	729	314	570	415	812
10-14	364	718	543	1085	340	640	469	935	329	576	312	645
15-19	272	515	448	865	302	575	471	921	287	533	310	629
20-24	163	304	219	415	179	382	235	486	167	339	203	419
25-29	144	300	108	252	169	350	144	280	188	391	151	298
30-34	160	355	104	259	191	387	88	223	210	492	94	267
35-39	189	380	127	332	164	347	86	200	192	404	115	223
40-44	187	402	172	352	167	373	94	229	199	406	80	198
45-49	205	407	176	346	186	375	114	286	161	342	77	173
50-54	197	376	188	363	179	370	137	291	160	343	75	190
55-59	149	321	112	252	188	384	128	274	171	354	83	231
60-64	134	267	98	211	202	402	160	307	184	397	117	246
65-69	114	228	100	221	119	275	106	235	150	328	121	256
70+	151	348	158	329	208	476	161	371	276	653	193	445
TOTAL	3047	6126	3648	7414	3187	6435	3118	6501	3298	6719	2712	5792

34—JONES

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	2378	4618	1266	2443	1579	3105	701	1401	1722	3401	805	1608
5- 9	2284	4462	1106	2184	1807	3621	888	1731	1599	3214	757	1475
10-14	2350	4606	891	1795	2225	4324	981	1889	1477	2907	543	1083
15-19	1972	3897	724	1410	2102	4036	876	1702	1663	3274	703	1349
20-24	1325	2719	415	920	1458	2985	386	871	1380	2801	425	912
25-29	1284	2670	339	829	1345	2676	253	599	1434	2771	306	723
30-34	1447	3006	347	796	1230	2473	246	594	1353	2715	229	563
35-39	1459	2981	283	716	1127	2353	256	629	1181	2358	191	454
40-44	1324	2739	322	734	1237	2574	292	668	1051	2117	207	498
45-49	1407	2745	336	773	1169	2517	254	632	903	1989	230	556
50-54	1243	2458	325	707	1143	2438	272	626	1068	2292	247	570
55-59	989	2085	288	604	1180	2435	280	590	980	2244	212	480
60-64	721	1552	223	501	1037	2221	286	643	954	2216	239	570
65-69	627	1323	216	470	767	1739	245	562	915	2028	238	549
70+	996	2234	289	565	1163	2906	379	817	1472	3930	474	1077
TOTAL	21806	44095	7370	15447	20569	42403	6595	13954	19152	40257	5806	12467

(CONTINUED)

35—KEMPER

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	172	338	524	1092	119	228	370	708	153	294	300	574
5- 9	169	381	593	1102	146	299	367	724	160	327	277	546
10-14	219	451	566	1102	194	382	400	803	134	257	282	522
15-19	289	494	432	825	267	494	379	733	231	395	235	483
20-24	136	243	223	419	151	259	196	387	134	222	139	283
25-29	91	199	135	305	100	197	109	222	92	199	96	198
30-34	104	221	120	284	107	207	102	206	119	220	90	191
35-39	117	259	139	273	106	228	83	199	116	226	67	144
40-44	159	315	126	282	111	233	109	244	114	218	93	179
45-49	192	370	148	328	140	285	81	183	127	252	48	136
50-54	128	272	153	307	141	282	91	215	98	208	79	186
55-59	160	311	162	309	154	312	121	235	112	241	66	131
60-64	125	246	95	214	140	300	138	259	154	311	82	179
65-69	123	237	110	238	117	270	130	272	113	273	97	207
70+	214	491	179	369	227	512	175	355	238	571	202	384
TOTAL	2398	4828	3705	7449	2220	4488	2851	5745	2095	4214	2153	4343

36—LAFAYETTE

0- 4	633	1233	585	1169	621	1214	388	778	1081	2122	437	876
5- 9	501	1036	556	1103	522	1102	488	946	871	1844	405	784
10-14	504	1025	481	908	583	1145	483	989	572	1127	320	658
15-19	1081	2004	367	726	1347	2493	455	882	1403	2645	399	757
20-24	1405	2229	196	429	2237	3799	212	452	2588	4273	213	497
25-29	493	839	146	350	683	1231	167	340	851	1531	207	413
30-34	316	656	138	323	416	800	132	314	662	1390	143	330
35-39	354	714	128	292	359	715	119	287	497	1061	136	278
40-44	330	687	134	300	319	641	110	259	420	784	105	252
45-49	342	697	163	358	346	697	111	224	351	698	103	219
50-54	298	635	168	316	320	676	112	255	309	630	92	220
55-59	306	629	125	246	317	664	120	283	321	664	82	176
60-64	219	460	93	208	271	604	127	262	291	643	85	215
65-69	189	438	78	171	236	560	115	251	244	592	110	293
70+	376	828	169	346	381	972	150	346	432	1215	173	411
TOTAL	7347	14110	3527	7245	8958	17313	3289	6868	10893	21219	3010	6379

37—LAMAR

0- 4	658	1262	196	358	591	1167	123	254	676	1341	130	267
5- 9	685	1257	164	309	658	1326	124	230	644	1302	118	219
10-14	677	1257	165	290	796	1486	155	285	715	1373	97	202
15-19	568	1031	95	177	702	1309	127	245	674	1383	96	182
20-24	330	668	68	126	478	963	74	162	562	1139	70	162
25-29	300	634	33	91	396	786	40	81	489	1000	53	112
30-34	290	621	41	102	374	759	39	90	542	1094	42	119
35-39	329	673	48	104	355	736	24	61	469	914	29	55
40-44	349	732	37	94	348	721	26	76	449	883	25	67
45-49	358	702	49	112	358	709	40	82	386	775	20	48
50-54	325	628	47	98	321	679	31	81	320	669	22	66
55-59	280	555	41	91	329	672	40	89	329	679	33	66
60-64	201	415	40	80	268	589	32	69	265	644	21	57
65-69	169	366	29	61	231	497	37	81	271	603	36	79
70+	326	642	75	139	341	788	61	136	412	1048	55	141
TOTAL	5845	11443	1128	2232	6546	13187	973	2022	7203	14847	847	1842

(CONTINUED)

TABLE 3, CONTINUED

38—LAUDERDALE

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	2103	4138	1766	3487	1688	3322	1151	2375	1881	3718	1014	2090
5- 9	2116	4212	1557	3196	1962	3802	1175	2386	1765	3431	986	2001
10-14	2059	4035	1279	2681	2032	3983	1349	2627	1631	3198	879	1788
15-19	1434	3008	908	1866	1956	3930	1131	2432	1814	3547	854	1815
20-24	1079	2393	670	1506	2655	4666	598	1377	2620	4606	631	1341
25-29	1153	2480	484	1186	1556	3018	438	974	2122	3956	546	1274
30-34	1442	3012	456	1159	1261	2579	431	1011	3103	5120	385	925
35-39	1456	3040	477	1169	1122	2400	376	907	1514	2922	340	745
40-44	1444	3017	524	1221	1350	2833	366	972	1181	2426	346	846
45-49	1367	2838	541	1193	1327	2792	408	957	1023	2205	322	743
50-54	1184	2496	495	1132	1294	2723	425	948	1210	2557	297	752
55-59	1072	2337	483	1054	1099	2399	417	887	1067	2362	314	710
60-64	817	1873	315	726	1022	2298	375	929	1117	2507	322	777
65-69	655	1625	317	784	794	1910	362	874	814	1961	313	734
70+	1246	3131	495	1124	1255	3531	482	1245	1418	4135	521	1447
TOTAL	20627	43635	10767	23484	22373	46186	9484	20901	24280	48651	8070	17988

39—LAWRENCE

0- 4	318	611	280	560	319	628	201	369	426	841	229	421
5- 9	310	610	311	611	385	750	208	438	413	806	195	411
10-14	319	601	263	516	410	824	256	530	411	848	184	348
15-19	310	564	221	416	333	632	263	492	414	778	176	352
20-24	158	343	74	161	214	441	100	218	275	608	97	225
25-29	162	337	65	140	233	480	70	137	250	541	83	162
30-34	186	375	70	137	244	492	49	128	330	634	66	173
35-39	210	416	71	161	226	465	59	126	325	662	64	124
40-44	170	329	71	161	221	440	59	131	290	577	41	126
45-49	192	397	97	190	230	443	64	146	248	495	53	114
50-54	184	401	81	183	160	327	74	141	208	438	61	115
55-59	174	356	73	162	186	397	73	163	223	442	48	127
60-64	150	306	55	128	185	404	75	165	161	330	69	128
65-69	128	270	63	132	140	319	70	163	150	358	70	164
70+	228	438	107	203	225	511	107	237	245	630	120	291
TOTAL	3199	6354	1902	3861	3711	7553	1728	3584	4369	8988	1556	3281

40—LEAKE

0- 4	450	868	613	1205	374	691	330	642	410	760	323	627
5- 9	497	939	630	1271	407	825	414	766	414	843	379	701
10-14	553	1083	610	1206	502	958	495	963	417	763	266	513
15-19	434	824	477	920	446	850	460	931	365	747	302	561
20-24	236	483	218	442	263	593	212	422	239	523	172	337
25-29	242	516	155	356	270	547	141	292	277	564	136	297
30-34	302	604	135	314	255	532	108	258	284	654	105	246
35-39	293	604	138	302	275	578	115	280	307	613	105	229
40-44	294	633	152	347	323	638	132	283	273	562	106	233
45-49	365	746	160	350	298	605	98	237	280	579	82	222
50-54	381	760	162	317	311	632	131	295	342	640	114	241
55-59	319	646	132	272	327	670	141	308	267	543	86	208
60-64	245	518	93	210	343	724	143	285	280	603	116	266
65-69	219	441	137	277	275	580	114	256	282	602	122	291
70+	439	894	169	312	449	1029	217	415	531	1304	258	497
TOTAL	5269	10559	3981	8101	5118	10452	3251	6633	4968	10300	2672	5469

(CONTINUED)

41—LEE

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	1596	3112	741	1536	1646	3126	495	1029	1921	3663	542	1126
5- 9	1466	2870	702	1358	1858	3538	585	1178	1842	3519	530	1067
10-14	1559	2962	579	1164	1818	3529	603	1258	1875	3545	403	843
15-19	1133	2277	482	966	1518	2985	538	1061	1924	3679	448	921
20-24	872	1856	295	633	1291	2792	299	645	1505	3336	311	698
25-29	980	1962	254	588	1220	2469	256	546	1635	3237	286	599
30-34	999	2062	218	498	1170	2442	242	522	1732	3672	245	532
35-39	1027	2083	215	510	1127	2228	202	476	1403	2803	204	442
40-44	932	1948	201	489	1108	2245	180	416	1298	2659	200	436
45-49	917	1905	246	541	1045	2153	154	369	1147	2302	145	345
50-54	853	1777	212	464	905	1948	165	395	1076	2243	148	336
55-59	699	1471	204	424	880	1845	176	401	1003	2085	110	274
60-64	578	1172	132	318	784	1696	179	383	832	1861	139	325
65-69	433	1014	183	352	579	1297	152	352	729	1626	131	336
70+	768	1829	218	448	866	2278	249	546	1085	3006	271	627
TOTAL	14812	30300	4882	10289	17815	36571	4475	9577	21007	43236	4113	8907

42—LEFLORE

0- 4	904	1770	2569	5055	698	1375	1525	2978	749	1481	1236	2411
5- 9	858	1713	2276	4538	838	1585	1655	3302	706	1339	1071	2134
10-14	795	1606	1949	3930	857	1707	1770	3407	662	1326	1051	2008
15-19	573	1172	1438	2933	764	1495	1506	3079	746	1385	1095	2240
20-24	381	882	813	1742	498	1159	781	1783	537	1230	709	1537
25-29	442	995	472	1180	592	1208	443	1026	789	1541	464	1077
30-34	560	1140	488	1247	520	1026	376	885	680	1348	361	910
35-39	522	1090	546	1324	460	984	304	757	616	1200	285	658
40-44	530	1103	600	1393	482	1014	348	915	448	912	268	648
45-49	542	1133	618	1439	481	1027	414	981	424	928	231	561
50-54	520	1073	613	1261	486	1046	457	1013	442	962	265	663
55-59	406	838	526	1135	475	1032	436	1015	422	937	292	692
60-64	307	658	423	888	432	941	456	961	404	919	340	773
65-69	218	509	478	995	310	725	427	1002	363	898	354	901
70+	378	1017	694	1383	397	1226	665	1457	501	1635	645	1532
TOTAL	7936	16699	14503	30443	8290	17550	11563	24561	8489	18041	8667	18745

43—LINCOLN

0- 4	987	1885	646	1296	722	1406	444	900	755	1477	510	1033
5- 9	940	1870	623	1230	816	1621	530	1029	728	1450	480	931
10-14	1038	1948	511	1068	933	1746	574	1146	682	1301	395	796
15-19	749	1451	360	734	781	1560	518	993	678	1352	441	831
20-24	452	959	202	440	628	1275	246	550	564	1142	276	588
25-29	515	1089	167	397	541	1087	149	355	564	1170	214	476
30-34	580	1189	176	404	503	995	127	302	699	1327	155	379
35-39	566	1155	160	358	458	963	138	324	481	961	123	290
40-44	514	1095	153	343	547	1119	147	345	474	936	106	258
45-49	584	1161	165	374	526	1113	162	363	426	929	140	329
50-54	581	1166	178	381	456	999	132	303	485	1020	127	305
55-59	431	920	144	327	503	1029	141	319	453	988	138	309
60-64	365	745	125	266	479	1046	132	327	376	902	98	262
65-69	281	647	127	293	337	778	142	315	393	867	139	307
70+	506	1127	220	441	559	1401	224	489	667	1807	236	554
TOTAL	9089	18407	3957	8352	8789	18138	3806	8060	8425	17629	3578	7648

(CONTINUED)

44—LOWNDES

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	1845	3589	1357	2721	1470	2701	985	1994	2310	4262	879	1778
5- 9	1450	2849	1285	2479	1612	3160	1046	2206	1687	3317	802	1690
10-14	1270	2581	1100	2198	1674	3331	1107	2164	1334	2504	804	1586
15-19	1028	2737	873	1756	1283	3484	906	1817	1426	3861	737	1622
20-24	1200	2688	537	1125	1942	4267	576	1177	2560	5499	580	1159
25-29	1238	2344	433	911	1276	2464	367	806	1593	3123	381	834
30-34	1015	1978	320	798	987	2043	308	754	1597	3247	330	786
35-39	988	1950	350	826	964	1939	319	695	994	2041	270	615
40-44	881	1700	329	815	881	1787	248	626	857	1850	239	592
45-49	689	1452	391	833	768	1596	258	588	749	1588	235	496
50-54	599	1229	303	721	733	1520	256	620	733	1604	193	476
55-59	471	998	349	688	618	1363	323	729	689	1497	213	516
60-64	390	856	203	471	505	1181	277	644	618	1462	234	554
65-69	310	689	279	621	375	902	289	646	492	1237	267	695
70+	516	1231	376	805	609	1598	361	898	746	2136	390	1042
TOTAL	13890	28871	8485	17768	15697	33336	7626	16364	18385	39228	6554	14441

45—MADISON

0- 4	497	966	1962	3836	452	859	1128	2240	651	1241	919	1823
5- 9	525	1003	1788	3470	540	1077	1277	2539	638	1276	941	1869
10-14	447	950	1657	3150	587	1153	1356	2647	534	1025	780	1546
15-19	303	640	1238	2445	498	974	1156	2396	512	1047	826	1756
20-24	182	407	714	1487	342	757	675	1470	449	916	552	1239
25-29	213	457	485	1062	358	738	366	800	588	1125	342	788
30-34	287	625	388	941	298	610	324	723	560	1135	306	716
35-39	277	577	388	917	317	664	279	667	533	1073	211	503
40-44	261	578	394	948	349	724	323	735	362	708	270	567
45-49	323	619	461	1005	331	685	285	662	379	788	205	482
50-54	268	540	405	862	290	578	302	669	388	729	248	521
55-59	220	446	408	865	278	566	316	688	285	629	195	453
60-64	228	449	327	723	219	512	290	626	237	547	216	486
65-69	145	322	364	784	206	451	273	615	260	572	211	489
70+	341	688	576	1142	316	800	497	1112	328	992	416	991
TOTAL	4517	9267	11555	23637	5381	11148	8847	18589	6704	13803	6638	14229

46—MARION

0- 4	834	1669	617	1212	620	1193	412	823	633	1224	405	808
5- 9	817	1574	562	1155	749	1483	420	854	617	1224	375	762
10-14	878	1667	488	994	896	1699	548	1047	666	1217	366	711
15-19	703	1351	411	793	836	1532	462	936	766	1441	345	692
20-24	410	836	206	429	507	1031	192	436	517	1050	216	457
25-29	408	851	144	356	435	868	133	277	517	982	150	329
30-34	447	936	149	337	410	830	123	277	507	1024	115	284
35-39	505	1012	141	325	413	882	106	278	440	898	98	215
40-44	471	957	160	360	447	919	127	291	410	815	105	239
45-49	464	987	173	369	455	918	127	273	372	800	95	231
50-54	430	874	154	351	443	945	134	280	420	908	106	226
55-59	343	728	136	313	418	935	125	298	410	868	92	221
60-64	293	598	122	252	377	794	132	296	388	859	115	237
65-69	249	512	115	272	265	630	121	302	323	813	111	288
70+	425	856	181	367	463	1080	216	464	529	1393	242	553
TOTAL	7677	15408	3759	7885	7734	15739	3378	7132	7515	15516	2936	6253

(CONTINUED)

47—MARSHALL

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	365	743	1473	2917	397	760	833	1693	572	1100	876	1778
5- 9	370	736	1302	2638	487	916	1068	2140	564	1066	843	1688
10-14	384	786	1137	2275	484	939	1148	2249	526	963	649	1305
15-19	312	593	952	1885	411	829	1009	2056	541	1031	828	1668
20-24	162	356	636	1338	270	601	555	1241	340	715	560	1224
25-29	173	379	363	792	315	632	307	631	415	887	325	689
30-34	218	412	292	682	278	559	249	545	463	942	217	506
35-39	213	480	299	651	242	512	217	502	441	856	184	399
40-44	224	437	289	628	290	549	243	555	370	745	207	444
45-49	215	409	340	683	242	516	219	513	275	552	159	397
50-54	227	442	249	538	248	498	245	532	321	625	206	470
55-59	169	352	261	543	224	438	247	494	252	554	159	371
60-64	148	289	224	467	196	413	216	463	214	466	213	458
65-69	131	296	266	510	130	307	195	462	172	379	185	419
70+	217	554	338	692	248	632	417	850	287	752	417	905
TOTAL	3528	7264	8421	17239	4462	9101	7168	14926	5753	11633	6028	12721

48—MONROE

0- 4	1124	2208	880	1791	1016	1965	626	1271	1063	2064	608	1232
5- 9	1060	2114	830	1664	1184	2262	677	1341	1126	2157	567	1121
10-14	1088	2182	835	1620	1135	2190	722	1436	1026	1950	514	1020
15-19	841	1757	595	1191	1012	1980	605	1180	1130	2120	493	951
20-24	675	1353	324	694	739	1663	345	713	771	1662	298	633
25-29	638	1314	219	490	758	1528	201	453	912	1726	204	447
30-34	680	1409	200	482	738	1452	183	429	808	1781	195	440
35-39	679	1437	200	509	620	1276	154	361	737	1484	141	333
40-44	668	1389	250	558	650	1361	163	402	705	1401	149	357
45-49	710	1434	250	581	652	1407	155	395	595	1248	119	280
50-54	594	1193	228	484	630	1364	185	423	613	1337	121	306
55-59	504	1046	225	501	650	1359	202	441	597	1336	125	298
60-64	424	876	147	365	557	1195	176	407	591	1373	143	358
65-69	378	852	219	440	415	934	207	450	535	1214	186	396
70+	627	1368	288	651	704	1714	313	691	826	2139	333	735
TOTAL	10690	21932	5690	12021	11460	23650	4914	10393	12035	24992	4196	8907

49—MONTGOMERY

0- 4	327	644	470	911	270	482	332	668	263	472	365	732
5- 9	331	661	465	939	282	598	330	736	220	467	286	636
10-14	321	688	415	817	345	686	409	809	285	513	289	594
15-19	282	592	323	593	306	565	392	791	261	509	278	620
20-24	160	342	125	293	163	361	151	328	175	359	149	325
25-29	165	357	85	206	198	413	126	254	215	395	153	342
30-34	174	371	99	278	187	381	76	191	191	402	92	213
35-39	194	434	126	283	206	407	71	198	247	472	105	239
40-44	241	459	118	265	177	384	83	262	190	394	64	179
45-49	221	488	134	273	169	396	113	248	179	369	64	173
50-54	242	494	116	241	227	418	110	236	167	348	77	230
55-59	215	438	116	225	208	476	138	263	159	387	116	237
60-64	174	367	82	174	222	469	93	213	208	395	88	209
65-69	165	347	84	185	183	387	110	223	177	422	131	261
70+	312	667	139	288	305	698	178	377	333	787	222	473
TOTAL	3524	7349	2897	5971	3448	7121	2712	5797	3270	6691	2479	5463

(CONTINUED)

TABLE 3, CONTINUED

50—NESHOBA

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	710	1407	454	957	566	1109	344	724	609	1197	404	849
5- 9	746	1501	429	869	626	1245	361	746	648	1291	357	737
10-14	824	1609	447	836	749	1454	409	812	597	1146	310	614
15-19	634	1227	302	587	664	1338	347	697	557	1110	292	598
20-24	314	648	185	377	462	947	165	391	420	856	151	385
25-29	317	685	119	277	401	825	124	271	420	902	142	323
30-34	436	934	130	290	373	725	130	296	549	1060	116	311
35-39	427	873	107	245	366	781	102	241	463	941	106	235
40-44	401	859	107	231	455	954	107	245	389	742	107	250
45-49	458	962	130	283	449	918	89	212	385	821	85	209
50-54	487	986	112	239	413	856	97	204	469	952	97	216
55-59	417	876	94	219	404	882	109	241	396	841	75	181
60-64	286	667	73	168	434	902	100	196	368	783	87	168
65-69	338	683	90	150	352	780	95	209	341	787	110	230
70+	533	1109	83	173	605	1375	106	226	727	1712	130	292
TOTAL	7328	15026	2862	5901	7319	15091	2685	5711	7338	15141	2569	5598

51—NEWTON

0- 4	491	995	469	928	449	846	281	623	561	1060	254	563
5- 9	610	1180	469	931	512	971	341	680	580	1104	278	553
10-14	657	1310	419	877	600	1155	396	774	549	986	237	519
15-19	659	1268	356	713	774	1572	330	649	650	1293	240	474
20-24	358	689	165	364	479	923	141	340	437	814	133	297
25-29	311	640	113	250	343	677	116	282	403	841	108	256
30-34	317	705	120	287	303	636	96	228	405	852	82	214
35-39	366	784	109	278	313	682	79	188	345	720	81	213
40-44	361	750	99	262	394	836	107	263	377	756	86	209
45-49	420	861	143	305	373	782	95	240	319	680	69	163
50-54	423	822	159	321	387	778	98	220	422	866	106	223
55-59	330	733	137	294	372	786	109	241	330	714	72	190
60-64	299	634	96	205	354	762	132	242	324	724	81	164
65-69	266	559	112	225	293	672	115	262	330	719	91	215
70+	479	1020	174	327	549	1274	187	399	629	1567	212	477
TOTAL	6347	12950	3140	6567	6495	13352	2623	5631	6661	13696	2130	4730

52—NOXUBEE

0- 4	209	442	1047	2011	141	309	537	1140	187	413	416	882
5- 9	230	439	882	1768	207	425	625	1280	186	383	420	859
10-14	251	476	850	1654	240	510	765	1471	162	357	392	834
15-19	181	330	661	1319	208	412	598	1214	187	400	424	879
20-24	129	256	335	706	148	303	257	508	142	328	231	451
25-29	108	236	234	518	114	230	161	350	131	290	146	323
30-34	133	273	204	469	128	246	163	391	147	291	125	279
35-39	155	303	162	431	134	271	152	345	141	265	105	233
40-44	118	268	214	470	140	283	143	361	135	256	114	302
45-49	148	310	207	483	152	301	125	311	131	269	117	250
50-54	156	308	225	438	142	325	162	356	168	342	108	273
55-59	129	282	180	409	163	310	148	366	167	302	89	236
60-64	119	244	178	362	132	278	194	376	120	296	140	306
65-69	101	202	206	434	92	240	171	385	116	258	141	345
70+	145	355	287	630	161	401	276	590	170	464	264	559
TOTAL	2312	4724	5872	12102	2302	4844	4477	9444	2290	4914	3232	7011

(CONTINUED)

53—OKTIBBEHA

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	745	1432	979	1977	668	1314	558	1100	1317	2603	584	1151
5- 9	553	1098	889	1783	624	1256	737	1509	980	1979	531	1085
10-14	551	1053	731	1468	680	1319	806	1583	610	1211	459	881
15-19	1358	1893	575	1110	1609	2651	654	1302	1816	3024	542	1102
20-24	2101	2758	332	686	2869	4340	332	656	3541	5413	366	708
25-29	646	1049	225	514	692	1290	232	487	820	1985	264	573
30-34	370	733	214	489	466	892	213	472	636	1590	213	450
35-39	384	770	199	460	409	824	169	406	438	1054	174	383
40-44	318	627	174	419	373	769	174	390	470	935	173	376
45-49	293	618	236	499	386	787	138	336	411	842	117	297
50-54	310	660	199	445	321	645	148	348	377	792	148	324
55-59	296	571	200	437	266	577	178	389	350	734	104	263
60-64	192	423	131	279	261	595	162	373	270	579	120	292
65-69	170	381	163	341	226	483	155	352	203	494	138	313
70+	270	661	244	541	329	827	197	480	425	1076	188	502
TOTAL	8557	14727	5491	11448	10179	18569	4853	10183	12664	24311	4121	8700

54—PANOLA

0- 4	620	1198	1388	2701	501	936	848	1695	546	1023	682	1362
5- 9	612	1205	1254	2405	632	1215	983	1958	530	1023	616	1226
10-14	690	1338	1109	2131	651	1292	1065	2002	526	1008	651	1255
15-19	510	1036	753	1539	617	1183	890	1733	637	1193	698	1412
20-24	297	650	410	838	375	787	386	823	354	762	371	772
25-29	324	676	305	672	370	760	220	529	448	868	260	591
30-34	331	680	286	644	345	717	192	426	436	870	181	420
35-39	356	726	281	673	315	682	224	507	360	767	162	400
40-44	368	779	273	669	354	726	201	499	369	766	135	330
45-49	414	830	351	760	367	727	227	516	325	682	181	390
50-54	413	837	347	684	347	758	213	540	334	706	157	403
55-59	336	674	295	638	388	820	279	559	344	718	180	378
60-64	262	540	264	523	378	799	261	541	318	726	160	432
65-69	227	476	269	524	270	583	248	541	312	712	235	474
70+	406	920	420	825	452	1076	453	899	556	1370	457	952
TOTAL	6166	12565	8005	16226	6362	13061	6690	13768	6395	13194	5126	10797

55—PEARL RIVER

0- 4	911	1782	412	829	993	1948	313	604	1301	2564	368	710
5- 9	985	1913	382	783	1236	2413	299	630	1467	2871	313	658
10-14	997	1902	280	605	1260	2482	379	721	1373	2713	288	527
15-19	863	1637	222	436	1211	2341	311	632	1520	2953	243	508
20-24	521	977	142	324	800	1653	143	345	1011	2163	194	407
25-29	399	883	129	286	731	1490	119	262	1026	2134	167	381
30-34	534	1105	113	255	691	1342	101	210	1061	2279	102	223
35-39	498	1081	114	245	650	1339	129	283	1191	2271	119	259
40-44	505	1021	97	234	688	1385	102	231	890	1685	91	190
45-49	497	998	133	268	654	1321	108	221	854	1642	122	255
50-54	443	917	95	195	540	1098	84	192	736	1490	88	190
55-59	438	854	103	212	493	1017	94	191	649	1347	76	157
60-64	305	666	82	166	426	909	76	179	519	1088	67	178
65-69	284	559	90	166	376	751	84	180	423	895	77	162
70+	462	926	89	186	512	1199	115	233	640	1605	121	267
TOTAL	8642	17221	2483	5190	11261	22688	2457	5114	14661	29700	2436	5072

(CONTINUED)

56—PERRY

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALF	TOTAL	MALF	TOTAL
0- 4	341	662	172	355	285	566	157	316	291	579	173	349
5- 9	355	719	166	336	348	689	149	310	300	595	168	351
10-14	384	734	167	327	360	732	154	313	301	627	141	279
15-19	310	631	123	228	351	664	131	265	344	637	118	245
20-24	157	338	47	101	221	463	82	168	207	464	76	161
25-29	146	311	55	110	174	380	57	112	197	398	61	131
30-34	186	371	44	116	192	394	38	86	270	540	66	142
35-39	174	371	53	118	161	352	32	73	192	430	33	74
40-44	168	329	50	100	191	390	36	96	197	414	31	71
45-49	172	352	57	115	172	369	51	103	159	350	31	64
50-54	200	356	39	87	158	312	48	106	180	370	35	105
55-59	153	301	61	120	176	360	40	85	176	377	36	76
60-64	128	268	44	83	182	345	47	94	144	305	58	115
65-69	111	210	29	80	134	261	40	88	154	312	26	63
70+	181	380	70	136	169	397	85	176	195	465	102	210
TOTAL	3166	6333	1177	2412	3274	6674	1147	2391	3307	6863	1155	2436

57—PIKE

0- 4	919	1857	1201	2356	615	1192	780	1512	626	1219	881	1704
5- 9	1003	1933	1168	2387	736	1429	883	1714	592	1152	799	1550
10-14	1002	1919	1048	2054	868	1645	1007	1950	581	1059	654	1252
15-19	800	1575	762	1486	871	1705	871	1773	639	1260	658	1273
20-24	448	980	367	808	529	1085	352	821	458	929	338	778
25-29	517	1077	289	654	464	957	287	598	505	1036	328	715
30-34	587	1163	276	642	415	878	246	547	490	974	236	556
35-39	576	1267	258	654	457	946	227	566	410	840	225	514
40-44	570	1185	305	682	497	1049	268	586	351	795	239	501
45-49	578	1237	360	752	524	1143	215	565	416	854	189	489
50-54	584	1187	339	761	506	1075	294	631	441	952	258	542
55-59	533	1145	279	581	485	1075	320	642	440	994	191	478
60-64	434	971	183	425	484	1068	275	639	419	970	238	529
65-69	346	801	214	446	385	931	227	535	350	876	260	588
70+	603	1358	336	720	656	1725	342	774	723	2069	394	950
TOTAL	9500	19655	7385	15408	8492	17903	6594	13853	7441	15979	5888	12419

58—PONTOTOC

0- 4	617	1193	247	463	575	1104	171	354	626	1208	203	421
5- 9	627	1262	260	471	653	1274	192	394	607	1187	194	399
10-14	773	1447	189	421	631	1266	208	418	588	1171	144	322
15-19	623	1135	185	357	600	1183	206	393	625	1195	152	331
20-24	304	645	84	199	423	907	112	237	345	801	123	236
25-29	295	597	80	158	412	800	62	127	397	839	69	140
30-34	351	743	64	133	347	719	46	123	483	1011	61	145
35-39	387	840	59	134	321	668	56	125	448	894	43	100
40-44	438	900	77	161	389	783	48	115	385	759	35	110
45-49	449	954	89	176	400	877	57	126	332	697	54	117
50-54	443	891	73	138	419	876	61	121	372	762	38	86
55-59	403	824	54	114	407	861	86	158	363	792	55	112
60-64	321	696	46	95	410	850	59	120	388	837	49	105
65-69	292	639	53	96	337	719	42	108	340	752	67	146
70+	553	1180	82	170	574	1367	90	190	650	1599	95	221
TOTAL	6876	13946	1642	3286	6898	14254	1496	3109	6949	14504	1382	2991

(CONTINUED)

59—PRENTISS

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	718	1375	153	320	757	1463	168	312	844	1637	223	416
5- 9	753	1468	149	294	780	1509	151	307	774	1502	166	336
10-14	900	1781	125	255	845	1652	154	314	891	1758	169	307
15-19	732	1421	96	206	824	1623	140	266	854	1669	142	278
20-24	389	803	75	151	633	1285	73	177	594	1191	90	218
25-29	354	760	49	107	526	1075	50	120	592	1229	73	153
30-34	422	935	55	114	445	942	50	114	724	1507	49	137
35-39	466	948	37	88	448	926	53	111	666	1312	54	124
40-44	476	1030	52	110	501	1031	47	98	528	1041	43	98
45-49	527	1095	49	107	493	996	36	83	474	973	52	105
50-54	458	968	44	101	486	1054	40	83	512	1055	36	74
55-59	379	770	31	72	500	1062	43	97	468	966	32	76
60-64	319	727	27	74	430	964	29	81	456	1051	26	65
65-69	286	604	41	89	340	729	30	72	449	1008	42	97
70+	483	1078	45	98	613	1465	52	122	779	1924	51	129
TOTAL	7662	15763	1028	2186	8621	17776	1116	2357	9605	19823	1248	2613

60—QUITMAN

0- 4	416	820	1149	2345	297	599	646	1247	236	479	354	682
5- 9	431	904	1059	2077	323	641	699	1371	221	440	308	604
10-14	488	983	884	1765	351	685	721	1395	251	501	405	744
15-19	387	744	612	1280	307	624	537	1094	230	443	354	722
20-24	184	390	294	615	234	503	234	475	168	350	191	375
25-29	166	359	180	440	205	417	176	356	163	351	154	304
30-34	194	401	195	466	176	347	152	308	224	447	121	238
35-39	227	458	218	527	146	316	103	258	180	367	101	208
40-44	231	468	253	564	166	344	112	269	151	298	87	177
45-49	252	488	271	600	179	371	145	338	115	256	69	166
50-54	209	422	245	541	167	366	151	345	120	269	67	165
55-59	177	332	255	529	216	423	156	340	153	321	83	191
60-64	151	301	230	430	162	342	180	382	129	297	111	243
65-69	117	256	236	478	118	244	184	393	144	312	113	253
70+	179	389	346	647	192	465	325	630	203	520	276	570
TOTAL	3809	7715	6427	13304	3239	6687	4521	9201	2688	5651	2794	5642

61—RANKIN

0- 4	1322	2518	765	1518	1500	2897	564	1160	2701	5240	739	1517
5- 9	1068	2066	737	1437	1662	3203	746	1451	2279	4406	728	1414
10-14	1023	1959	710	1414	1648	3189	714	1378	1870	3670	526	1052
15-19	758	1472	669	1286	1245	2488	673	1290	1937	3856	681	1302
20-24	640	1466	409	824	1031	2360	386	834	1661	3849	388	811
25-29	812	1623	314	609	1259	2538	319	643	2068	4295	321	645
30-34	803	1549	332	652	1178	2360	296	587	1898	3800	279	593
35-39	656	1327	284	664	1056	2163	292	582	1637	3383	297	616
40-44	613	1269	319	705	1037	1991	287	598	1521	3033	256	539
45-49	687	1366	397	831	810	1614	239	571	1304	2630	246	499
50-54	654	1273	340	708	747	1543	322	666	1264	2422	290	567
55-59	564	1091	305	635	698	1463	317	683	823	1729	191	471
60-64	389	788	246	515	635	1299	330	656	725	1579	313	618
65-69	275	617	181	422	446	959	267	527	552	1297	278	566
70+	520	1120	278	598	626	1462	348	778	903	2158	466	992
TOTAL	10784	21504	6286	12818	15578	31529	6100	12404	23143	47347	5999	12202

(CONTINUED)

62—SCOTT

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	674	1346	591	1215	574	1134	345	744	586	1164	322	694
5- 9	712	1378	576	1137	675	1383	424	886	579	1191	372	777
10-14	676	1393	579	1113	837	1568	512	1004	713	1322	299	614
15-19	539	1046	390	821	621	1231	446	886	589	1237	328	690
20-24	341	688	211	474	412	902	261	522	510	1010	231	471
25-29	330	709	151	364	415	833	115	265	478	981	132	285
30-34	388	788	143	342	421	855	124	285	509	1122	153	313
35-39	362	773	152	346	387	778	135	328	487	918	103	239
40-44	408	789	165	354	429	873	123	300	465	947	107	250
45-49	402	819	168	378	368	778	119	263	393	783	106	249
50-54	368	741	169	372	399	790	129	288	420	876	96	245
55-59	360	723	178	359	369	785	149	305	338	747	106	213
60-64	254	525	119	245	365	742	151	316	396	791	115	244
65-69	212	451	121	235	300	629	134	287	307	684	112	244
70+	427	881	200	382	400	973	212	436	477	1237	239	527
TOTAL	6453	13050	3913	8137	6972	14254	3379	7115	7247	15010	2821	6055

63—SHARKEY

0- 4	158	330	600	1294	128	245	395	776	128	246	295	580
5- 9	177	349	583	1194	147	300	455	887	127	260	256	499
10-14	167	355	525	1023	144	301	467	920	117	224	307	556
15-19	152	296	395	740	141	276	372	757	117	237	290	562
20-24	69	146	162	355	74	165	133	311	64	140	118	280
25-29	77	171	111	266	107	213	89	209	99	198	84	218
30-34	101	198	104	276	84	168	75	186	90	189	62	164
35-39	93	194	118	286	80	166	68	172	111	208	55	136
40-44	98	213	128	316	93	184	85	206	77	156	61	139
45-49	94	201	149	319	84	193	81	189	72	165	47	114
50-54	111	197	141	298	95	206	92	224	90	178	61	146
55-59	96	163	158	316	89	191	109	223	80	184	59	131
60-64	69	148	118	236	98	173	106	225	84	181	69	169
65-69	56	113	106	226	71	137	105	205	66	166	72	144
70+	89	173	165	346	88	207	155	322	106	247	146	300
TOTAL	1607	3247	3563	7491	1523	3125	2787	5812	1428	2979	1982	4138

64—SIMPSON

0- 4	673	1283	549	1066	505	1035	370	716	546	1124	328	634
5- 9	700	1355	520	1048	673	1299	388	791	601	1165	323	657
10-14	704	1365	510	1012	699	1385	459	854	525	1121	309	573
15-19	548	1066	415	793	634	1205	390	771	610	1156	291	582
20-24	316	645	163	375	391	815	207	444	388	828	186	372
25-29	347	694	140	298	377	814	156	308	436	918	147	300
30-34	387	819	130	311	391	760	97	229	484	960	123	271
35-39	385	751	127	299	359	747	115	234	390	879	128	242
40-44	387	786	129	302	397	852	112	246	401	790	84	182
45-49	419	871	168	326	398	757	106	242	371	752	96	190
50-54	453	885	149	311	350	753	128	278	359	819	111	227
55-59	363	727	141	286	413	837	130	257	392	729	82	191
60-64	307	597	100	218	378	780	102	233	292	667	88	209
65-69	255	517	107	226	286	617	129	256	325	711	119	230
70+	423	893	186	329	468	1022	195	410	538	1236	211	479
TOTAL	6667	13254	3534	7200	6719	13678	3084	6269	6658	13855	2626	5339

(CONTINUED)

65—SMITH

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	511	1035	264	531	408	770	184	394	472	895	133	285
5- 9	578	1103	287	529	484	926	199	425	474	910	126	269
10-14	598	1197	238	485	525	1031	207	419	419	769	144	311
15-19	536	1000	188	358	500	985	185	353	419	827	128	285
20-24	258	573	103	215	358	711	111	228	314	612	97	197
25-29	259	540	69	151	295	588	78	164	275	581	77	162
30-34	293	618	55	117	286	600	71	141	397	749	77	150
35-39	299	615	65	161	265	549	39	100	302	598	44	108
40-44	326	647	69	141	304	622	53	97	297	604	68	118
45-49	351	713	89	158	304	615	52	132	269	549	31	82
50-54	368	725	47	100	306	630	69	121	285	606	53	85
55-59	295	603	49	84	321	631	42	90	278	544	25	81
60-64	245	493	20	55	303	615	41	88	252	535	60	106
65-69	234	437	42	73	214	484	45	78	233	505	39	84
70+	399	757	46	89	399	852	67	122	416	996	95	163
TOTAL	5550	11056	1631	3247	5272	10609	1443	2952	5102	10280	1197	2486

66—STONE

0- 4	238	510	128	249	253	473	136	246	354	664	157	284
5- 9	259	509	114	238	272	520	132	250	316	604	140	263
10-14	283	551	122	225	312	631	145	243	332	590	154	243
15-19	359	671	67	109	442	815	106	218	464	834	123	230
20-24	179	322	43	96	242	474	77	152	267	543	92	163
25-29	137	289	41	86	197	366	34	75	243	445	54	163
30-34	145	288	45	95	157	327	36	80	212	488	64	126
35-39	155	312	41	82	154	306	36	78	221	390	30	68
40-44	144	303	38	78	170	341	35	85	184	387	28	72
45-49	141	296	50	96	194	375	43	85	193	368	38	81
50-54	158	302	31	69	145	333	35	71	171	373	32	77
55-59	125	258	27	60	152	306	38	74	209	389	33	66
60-64	110	194	28	63	155	307	26	64	142	340	29	65
65-69	87	186	27	61	99	221	19	48	120	261	27	59
70+	148	311	51	104	212	425	54	112	286	586	50	109
TOTAL	2668	5302	853	1711	3156	6220	952	1881	3714	7262	1051	2069

67—SUNFLOWER

0- 4	723	1412	2614	5192	451	912	1569	3205	502	1019	1028	2098
5- 9	779	1520	2408	4759	530	1119	1654	3288	471	997	902	1792
10-14	798	1570	2019	4052	649	1273	1764	3384	405	823	1059	2087
15-19	666	1256	1549	3066	754	1443	1424	2810	513	1061	978	1941
20-24	489	840	947	1772	540	980	843	1600	439	795	737	1340
25-29	443	809	669	1334	493	860	538	1067	558	987	495	978
30-34	449	897	621	1305	410	775	423	845	453	911	377	764
35-39	496	928	646	1329	405	743	359	779	451	790	289	623
40-44	469	936	626	1340	393	797	397	847	359	688	270	548
45-49	488	982	698	1407	413	812	384	856	337	649	213	503
50-54	478	903	660	1304	372	790	404	855	312	674	256	540
55-59	377	734	579	1111	383	811	416	875	324	670	229	535
60-64	297	604	408	841	391	770	395	855	304	677	242	564
65-69	244	515	462	909	236	511	406	817	240	570	292	647
70+	358	824	672	1299	403	1023	603	1345	462	1219	549	1343
TOTAL	7554	14730	15578	31020	6823	13619	11579	23428	6130	12530	7916	16303

(CONTINUED)

68—TALLAHATCHIE

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	388	813	1344	2701	245	513	843	1662	265	559	520	1023
5- 9	470	918	1209	2413	366	690	902	1729	284	537	462	885
10-14	480	929	1097	2131	369	775	874	1672	233	489	548	1030
15-19	413	736	791	1604	379	701	697	1432	295	528	520	1025
20-24	187	373	343	735	197	414	304	674	151	347	242	528
25-29	177	393	209	497	187	399	180	451	172	383	159	404
30-34	221	447	227	553	195	387	152	335	205	429	135	308
35-39	244	501	245	591	183	401	129	338	193	407	111	308
40-44	267	564	266	629	208	412	141	375	184	357	94	225
45-49	305	592	307	684	220	453	164	377	165	363	86	215
50-54	282	552	313	630	225	481	193	411	175	351	102	243
55-59	188	417	326	635	243	496	207	479	175	380	111	265
60-64	173	328	227	452	221	489	219	460	176	430	135	301
65-69	179	368	260	503	165	374	279	545	213	444	177	411
70+	287	649	369	743	294	672	372	741	313	771	378	762
TOTAL	4261	8580	7533	15501	3697	7657	5656	11681	3199	6775	3780	7933

69—TATE

0- 4	366	690	959	1936	393	766	577	1124	642	1256	491	956
5- 9	352	677	802	1645	474	889	636	1276	654	1231	401	803
10-14	427	816	692	1378	462	861	697	1389	496	955	419	806
15-19	466	871	483	1016	605	1242	595	1193	815	1628	472	926
20-24	281	492	262	574	428	814	244	533	463	859	246	538
25-29	198	393	167	425	302	619	128	323	392	891	158	377
30-34	182	392	187	411	278	545	126	313	423	911	117	290
35-39	210	436	175	401	220	467	108	283	336	738	83	215
40-44	209	472	205	435	265	510	143	304	405	716	96	230
45-49	235	482	217	475	238	508	134	304	249	544	83	215
50-54	243	451	169	362	228	502	150	319	289	544	105	223
55-59	169	348	190	368	241	535	135	303	244	565	83	194
60-64	153	321	127	265	241	472	154	322	226	530	137	284
65-69	135	305	153	316	176	366	143	305	251	563	102	255
70+	239	550	227	435	276	681	226	476	363	878	233	518
TOTAL	3865	7696	5015	10442	4827	9777	4196	8767	6248	12809	3226	6830

70—TIPPAH

0- 4	529	1067	213	401	534	1063	141	276	560	1119	136	267
5- 9	591	1198	191	385	635	1181	170	314	620	1155	138	255
10-14	622	1207	184	361	638	1223	200	369	644	1219	132	253
15-19	587	1173	155	287	589	1242	165	305	633	1220	147	251
20-24	292	704	72	178	391	898	68	155	401	908	74	157
25-29	303	636	59	113	376	779	66	123	377	826	70	130
30-34	323	678	49	116	365	739	36	105	489	949	34	91
35-39	325	686	44	119	340	683	59	112	422	837	66	122
40-44	378	768	61	121	345	731	57	113	390	797	42	100
45-49	396	816	82	148	345	699	26	96	361	697	35	84
50-54	373	747	49	111	350	741	60	101	319	706	56	94
55-59	314	636	57	114	390	806	70	133	340	691	22	89
60-64	276	556	49	84	359	732	58	118	337	727	71	111
65-69	230	497	35	67	276	605	53	108	343	768	65	126
70+	465	968	82	151	497	1138	85	164	579	1399	100	213
TOTAL	6004	12337	1382	2756	6430	13260	1314	2592	6815	14018	1188	2343

(CONTINUED)

71—TISHOMINGO

	1960				1970				1980 (PROJECTION)			
AGE	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	554	1090	51	93	503	1031	26	51	551	1134	41	79
5- 9	684	1292	44	78	698	1309	36	76	677	1273	34	71
10-14	702	1425	45	77	683	1308	54	93	620	1236	28	51
15-19	628	1207	29	65	653	1258	50	82	666	1274	41	79
20-24	307	655	20	34	445	932	18	37	433	854	22	45
25-29	274	642	21	36	449	898	14	31	467	936	24	39
30-34	363	745	6	20	368	775	12	27	533	1103	11	31
35-39	388	772	12	28	347	755	17	30	569	1067	11	26
40-44	372	819	14	30	411	855	11	28	417	890	22	40
45-49	407	856	14	36	402	803	10	25	360	786	14	26
50-54	399	816	10	30	392	823	14	37	433	861	11	35
55-59	369	734	25	43	369	832	12	31	364	778	9	22
60-64	285	616	12	26	378	811	13	36	371	819	18	44
65-69	266	529	13	31	317	666	24	35	317	760	12	24
70+	480	1012	35	52	557	1212	28	53	676	1512	30	60
TOTAL	6478	13210	351	679	6972	14268	339	672	7454	15283	328	672

72—TUNICA

0- 4	196	364	1203	2413	129	257	620	1268	112	223	312	637
5- 9	203	420	989	1944	149	301	622	1212	113	229	243	473
10-14	206	402	905	1696	156	310	659	1286	103	220	340	676
15-19	136	274	657	1289	166	310	523	1015	122	223	329	633
20-24	90	181	303	639	87	197	208	444	66	152	151	338
25-29	73	170	214	478	92	184	114	293	112	208	91	230
30-34	112	228	195	472	92	174	120	256	89	188	82	178
35-39	104	217	207	526	62	150	101	254	78	161	54	158
40-44	116	234	248	553	116	240	98	256	95	183	60	138
45-49	102	213	250	588	93	196	149	335	55	135	73	162
50-54	103	201	252	534	94	195	131	291	94	200	52	135
55-59	90	183	283	531	86	172	151	340	78	158	90	194
60-64	64	127	225	466	83	171	162	353	76	167	84	192
65-69	55	124	272	532	60	156	170	346	57	146	91	225
70+	77	167	362	660	84	212	345	680	97	277	272	566
TOTAL	1727	3505	6565	13321	1549	3225	4173	8629	1347	2870	2324	4935

73—UNION

0- 4	738	1422	233	452	645	1252	172	385	710	1383	175	391
5- 9	766	1545	242	467	694	1386	177	316	672	1346	170	304
10-14	876	1677	218	410	741	1460	173	351	648	1286	128	301
15-19	664	1252	161	309	733	1450	169	336	664	1301	124	227
20-24	396	832	83	176	554	1150	92	203	469	1004	73	176
25-29	369	772	64	151	458	939	86	171	506	1093	90	186
30-34	441	911	65	131	420	864	52	116	588	1195	58	134
35-39	471	966	61	139	397	826	42	104	493	1005	56	117
40-44	492	1013	68	169	477	946	45	107	454	897	36	96
45-49	514	1033	84	185	448	899	46	113	378	769	32	85
50-54	434	885	63	144	454	974	56	132	440	908	37	84
55-59	424	855	67	155	449	959	65	148	391	834	36	91
60-64	306	657	44	97	416	865	69	136	435	953	61	124
65-69	271	601	66	119	369	794	53	115	391	894	51	109
70+	551	1171	105	208	554	1381	95	218	658	1739	96	244
TOTAL	7713	15592	1624	3312	7809	16145	1392	2951	7897	16607	1223	2669

(CONTINUED)

74—WALTHALL

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	366	674	413	895	266	505	312	593	292	557	268	508
5- 9	358	676	451	948	350	643	332	647	329	606	282	550
10-14	383	769	477	961	368	705	387	795	267	529	292	530
15-19	343	669	375	734	314	592	324	680	307	563	239	465
20-24	198	393	146	298	185	402	141	319	178	367	114	264
25-29	195	401	107	234	209	437	112	239	191	385	97	223
30-34	203	415	111	264	216	426	76	159	202	436	73	170
35-39	215	464	107	235	188	405	81	191	201	441	85	195
40-44	249	489	117	250	225	458	82	199	239	470	56	119
45-49	261	535	126	268	214	452	82	194	187	394	62	158
50-54	225	458	121	231	244	469	99	219	220	438	69	175
55-59	191	388	100	217	223	481	93	223	183	407	61	164
60-64	161	338	54	142	210	454	97	198	228	464	79	189
65-69	134	295	81	160	158	358	87	173	184	446	81	177
70+	224	448	139	263	264	616	120	268	321	820	133	303
TOTAL	3706	7412	2925	6100	3634	7403	2425	5097	3529	7323	1991	4190

75—WARREN

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	1331	2578	1325	2755	1192	2340	910	1853	1457	2873	1088	2213
5- 9	1198	2341	1240	2504	1377	2676	1062	2185	1426	2780	974	2001
10-14	1145	2172	1022	2102	1416	2804	1191	2475	1268	2546	818	1665
15-19	772	1581	722	1442	1177	2311	1013	2023	1353	2642	868	1765
20-24	524	1244	441	966	760	1799	453	1094	940	2344	528	1290
25-29	625	1350	348	799	1003	1969	313	766	1529	2883	439	1074
30-34	700	1442	340	874	814	1661	293	716	1181	2403	301	817
35-39	694	1488	382	930	743	1548	335	750	1192	2265	301	718
40-44	739	1533	446	1039	743	1518	312	761	864	1749	269	525
45-49	690	1412	483	1122	734	1511	350	834	786	1574	307	674
50-54	693	1414	543	1073	711	1504	393	871	715	1489	275	637
55-59	546	1119	441	1009	614	1277	389	887	653	1367	282	659
60-64	380	809	373	842	562	1180	421	898	577	1257	305	735
65-69	333	761	417	940	388	920	367	868	436	1052	324	763
70+	443	1203	575	1362	495	1456	629	1526	619	1874	653	1598
TOTAL	10813	22447	9098	19759	12729	26474	8431	18507	14996	31098	7732	17234

76—WASHINGTON

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	2558	4942	3426	6954	1537	2872	2480	4981	1455	2731	2190	4393
5- 9	2082	4147	3140	6313	1607	3224	2644	5211	1071	2155	1934	3808
10-14	1796	3464	2670	5172	1846	3470	2742	5491	1109	2018	1985	3934
15-19	1161	2381	1892	3814	1481	2965	2294	4570	1143	2305	1932	3773
20-24	1449	2833	1020	2228	1008	2260	1070	2397	1036	2255	1099	2557
25-29	1500	2911	750	1753	1116	2206	714	1676	1424	2750	866	2005
30-34	1306	2626	776	1934	922	1924	614	1463	641	1547	644	1577
35-39	1236	2469	752	1883	959	1986	561	1326	713	1506	534	1268
40-44	1090	2075	763	1913	977	2024	618	1539	690	1485	489	1164
45-49	920	1849	913	2160	923	1905	608	1480	716	1534	454	1044
50-54	770	1581	993	2113	865	1759	592	1493	775	1725	479	1201
55-59	577	1132	849	1787	741	1559	686	1565	743	1608	457	1072
60-64	432	912	638	1413	572	1258	771	1650	643	1399	460	1167
65-69	329	720	715	1568	419	907	666	1502	538	1257	538	1321
70+	477	1197	1095	2394	534	1484	1021	2434	658	1926	1025	2535
TOTAL	17683	35239	20392	43399	15507	31803	18081	38778	13355	28201	15086	32819

(CONTINUED)

77—WAYNE

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	596	1202	472	949	449	913	324	675	535	1094	349	726
5- 9	566	1132	419	796	553	1091	373	728	493	976	352	686
10-14	613	1160	420	824	639	1253	420	812	481	951	288	576
15-19	489	955	311	607	569	1107	316	639	556	1067	281	585
20-24	325	618	162	347	366	771	159	363	382	837	159	357
25-29	295	627	124	251	335	700	119	273	390	811	121	289
30-34	282	564	99	229	324	667	91	202	365	839	89	211
35-39	311	631	98	236	340	673	85	220	386	752	82	246
40-44	289	552	95	239	279	598	95	203	321	709	87	179
45-49	288	581	132	270	301	587	88	191	329	627	76	177
50-54	268	522	104	220	307	575	92	205	296	621	92	177
55-59	249	532	110	220	259	535	117	237	271	540	78	168
60-64	207	421	80	165	254	513	91	212	291	564	81	199
65-69	197	381	88	171	201	449	89	219	209	451	95	237
70+	273	571	150	285	309	737	139	302	349	924	139	362
TOTAL	5248	10449	2864	5809	5485	11169	2598	5481	5654	11763	2369	5175

78—WEBSTER

0- 4	340	676	206	438	274	535	140	257	306	601	116	213
5- 9	359	716	192	386	334	665	136	283	344	688	105	218
10-14	369	732	187	335	351	706	165	338	283	559	112	199
15-19	382	737	120	269	351	697	137	280	327	648	97	205
20-24	199	384	83	165	228	464	61	124	217	448	54	128
25-29	160	354	57	120	227	444	42	87	209	420	48	91
30-34	195	389	51	127	190	403	44	93	218	490	32	70
35-39	219	471	46	107	178	382	41	98	253	481	30	71
40-44	216	446	50	122	213	423	43	97	208	439	37	72
45-49	262	520	71	128	208	435	41	93	169	353	37	86
50-54	247	519	49	103	210	424	36	89	207	402	31	71
55-59	230	448	41	89	230	477	62	105	183	400	36	75
60-64	202	424	22	54	232	488	45	99	197	398	33	86
65-69	177	368	43	86	197	430	38	91	197	461	57	104
70+	356	754	57	113	364	816	60	124	393	917	70	154
TOTAL	3913	7938	1275	2642	3787	7789	1091	2258	3711	7705	895	1843

79—WILKINSON

0- 4	187	350	700	1419	133	260	331	684	156	308	357	737
5- 9	185	370	743	1452	182	347	495	971	153	292	405	793
10-14	203	387	663	1339	186	349	556	1105	132	259	263	533
15-19	164	324	511	983	146	303	518	984	144	284	345	658
20-24	84	179	229	463	108	213	186	448	99	192	156	369
25-29	95	167	161	384	92	210	116	287	82	198	118	287
30-34	90	203	162	393	103	205	139	307	132	245	113	301
35-39	102	208	174	408	101	187	112	268	98	239	81	201
40-44	108	248	208	423	81	188	116	299	93	190	100	233
45-49	113	224	224	425	96	185	136	311	95	167	88	205
50-54	145	271	203	390	102	229	175	357	76	173	98	253
55-59	120	247	162	338	95	205	178	351	81	169	108	259
60-64	94	188	131	260	123	230	161	344	87	195	139	317
65-69	78	160	163	317	76	181	138	296	60	151	152	307
70+	129	281	206	434	124	296	251	499	133	334	276	562
TOTAL	1897	3807	4640	9428	1748	3588	3608	7511	1621	3396	2799	6015

(CONTINUED)

TABLE 3, CONTINUED

80—WINSTON

AGE	1960				1970				1980 (PROJECTION)			
	WHITE		NONWHITE		WHITE		NONWHITE		WHITE		NONWHITE	
	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL	MALE	TOTAL
0- 4	491	958	655	1287	410	778	435	902	499	949	408	844
5- 9	542	1048	663	1289	417	892	414	869	449	963	380	796
10-14	546	1101	664	1234	540	1031	519	1011	451	838	345	709
15-19	412	837	443	860	486	946	475	955	374	806	297	646
20-24	269	515	223	453	327	673	221	474	323	629	173	391
25-29	243	527	143	375	314	656	146	323	370	740	157	361
30-34	302	650	149	352	311	597	106	247	378	780	105	260
35-39	321	645	154	350	294	620	115	274	380	773	117	238
40-44	312	662	149	353	329	718	151	335	339	659	107	235
45-49	379	759	176	374	327	640	128	292	299	614	96	229
50-54	381	750	168	367	298	637	147	330	314	691	149	314
55-59	304	627	166	305	326	708	138	312	281	596	100	244
60-64	243	493	99	208	349	688	136	299	273	584	119	269
65-69	208	453	109	222	238	530	162	313	255	600	135	324
70+	397	828	195	364	411	951	222	405	484	1167	286	519
TOTAL	5350	10853	4156	8393	5377	11065	3515	7341	5469	11389	2974	6379

81—YALOBUSHA

0- 4	287	524	408	832	230	441	255	566	287	553	248	550
5- 9	302	579	415	835	294	553	339	622	281	530	285	524
10-14	390	696	425	780	344	645	343	711	276	544	214	484
15-19	287	541	316	581	288	570	325	648	280	544	265	483
20-24	137	273	143	297	198	419	150	317	175	392	121	294
25-29	135	285	94	217	193	377	90	197	194	398	93	223
30-34	136	320	91	207	150	298	73	176	217	457	77	189
35-39	172	369	76	201	164	352	75	158	234	465	72	144
40-44	193	412	104	230	161	360	72	177	178	338	58	151
45-49	224	490	114	234	192	402	70	182	183	383	69	143
50-54	238	491	115	231	188	436	87	201	157	382	60	155
55-59	221	427	98	219	221	494	92	190	189	405	56	147
60-64	178	403	90	188	232	499	84	174	183	445	64	152
65-69	196	410	77	163	186	399	83	201	186	468	78	174
70+	314	742	151	325	335	826	159	324	367	917	163	335
TOTAL	3410	6962	2717	5540	3376	7071	2297	4844	3387	7221	1923	4148

82—YAZOO

0- 4	663	1309	1455	2902	473	933	798	1678	438	867	572	1201
5- 9	710	1392	1350	2644	628	1180	982	1941	493	930	584	1154
10-14	677	1388	1221	2447	664	1346	1083	2104	474	960	594	1215
15-19	509	1051	955	1828	630	1155	897	1732	557	982	652	1271
20-24	278	601	454	975	348	731	347	724	341	708	308	622
25-29	306	686	306	717	366	767	220	526	453	841	207	500
30-34	415	848	305	766	325	673	220	533	407	820	168	394
35-39	379	791	355	822	332	725	188	471	397	812	135	346
40-44	378	819	371	836	414	841	227	549	324	667	164	383
45-49	398	786	401	890	388	769	269	649	340	703	142	372
50-54	398	760	380	815	348	742	306	657	381	762	187	430
55-59	327	658	370	755	356	716	286	668	347	701	192	489
60-64	252	507	282	623	340	687	324	647	297	675	261	522
65-69	195	454	328	677	239	519	286	647	260	565	221	579
70+	346	812	500	1094	310	906	500	1088	348	1092	500	1083
TOTAL	6231	12862	9033	18791	6161	12690	6933	14614	5857	12085	4887	10561

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The Influence of Row Spacing on Cotton Variety Preformance

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The Influence of Row Spacing on Cotton Variety Performance

Cotton is traditionally grown in e United States in single rows paced 38-42 inches apart. How-ver, several reports from outside e Mississippi Delta have shown at certain varieties are better dapted to high population produc-on systems (5, 14, 15).

Ray (10) and Niles (9) have dis-ussed the development of varieties dapted to narrow row production nd have emphasized that the ma-r hurdle in realizing the full otential of this type culture is the evelopment of a suitable variety. reviously, breeders have succeed-d in developing cotton types to neet special situations in the past, nd will continue to develop new ypes as the economic need arises.

The spread of boll weevil, *nthonomus grandis* Boh. over the otton Belt caused a widespread hange in the types of cotton grown n different areas. The advent of he boll weevil made it difficult to row late-maturing varieties. The ate-maturing long staple varieties ommonly grown before the turn of he century were replaced by early-maturing, short staple varieties that allowed cotton to be grown profitably in spite of the boll weevil.

The heavy selection pressure for yield since the early 1900's has resulted in highly productive varieties (2). These varieties are usually not adapted to narrow row production. Yield continues to be the prime character of selective importance, but in recent years a great deal of breeding attention has been given to the development of cottons to meet special situations.

Research in the Texas High Plains has shown the potential for reduced production costs, increased yields, and improved fiber uniformity by using row widths narrower than 40-inches (1, 11, 12, 13, 16, 17). This does not mean that the same production practices in other areas would be equally successful, since environments are sometimes drastically different in various cotton producing areas.

To determine the effect of row spacing on the agronomic and fiber properties of cotton, we evaluated several varieties in 1970, 1971, 1972, and 1973 when planted in different row spacings. Eight varieties in 1970, five in 1971, and four in 1972 and in 1973 were evaluated. The varieties were planted in 20- and 40-inch rows in 1970 and in 15-, 30-, and 40-inch rows during 1971-73. Three varieties ('Coker 310', 'Deltapine 16', and 'Stoneville 213') were included over a 3-year period (1971-73).

A split-plot design with five replications was used each year. Main plots were varieties and subplots were row spacings. The plots consisted of six 40-inch rows, eight 30-inch rows, twelve 20-inch rows and fifteen 15-inch rows. Each plot was 75 feet long. The seeding rate was approximately 30 pounds of acid-delinted seed per acre with a final plant population of about 65,000 plants per acre. Nitrogen was applied at the rate of 80 pounds per acre. The plots were hand-picked to obtain a measure of earliness.

Results and Discussion

The response of cotton varieties o narrow row production has been omewhat inconsistent. Grissom nd Spurgeon (6) grew cotton in 20-, 0-, 60-, and 80-inch rows at Stoneville and reported no difference in yield attributed to row spacings when averaged over four years. They observed that dry weather tended to affect cotton in 20-inch rows more quickly and more severely than on wider spaced rows.

In our study a drought stress was evident at a much earlier date for the 20-inch rows in 1970. The 20-inch rows tended to "cut-out" earlier and form more regrowth later in the season when moisture was available. This regrowth on 20-inch row plots actually caused them to mature later than 40-inch row plots. The same general trend was usually observed on 15-inch rows in 1971-73.

In 1970 the lint yield of Delta variety types was reduced 7% when planted in 20-inch rows (Table 1.). The storm-proof varieties commonly grown in Texas yielded 6 to 20% more when planted in 20-inch rows, but the lint yield of these varieties was lower than that of standard Delta types regardless of row spacing. 'Lockett 4789A', 'Arkansas 61-28', and 'Paymaster Dwarf' yielded 20, 14, and 6% more, respectively, when grown in 20-inch rows. The yield of Paymaster Dwarf and Arkansas 61-28 was partially confounded with grass control when planted in 40-inch rows. These short stature varieties did not provide enough shading to reduce grass growth. The low yield of these two varieties when planted in 40-inch rows was partially due to inadequate late season grass control.

In 1971 the lint yield of Delta varieties was 4 to 10% higher in 30-inch rows than in 40-inch rows (Table 2.). One Delta type, Coker 310, showed a 13% increase in yield

Table 1: Influence of row-spacing on eight cotton varieties, Stoneville, Mississippi, 1970

Variety	Row width	Lint per acre	40-in. rows	Lint	Boll size	Length		Fiber Properties		
								Strength*	Elongation**	Micronai
	in	*lb*	*%*	*%*	*Grams*	*2.5%*	*50%*	*g/tex*		
Stoneville 213	40	873		38.2	5.53	1.14	.55	18.64	7.44	5.17
Stoneville 213	20	823	94	37.7	5.27	1.13	.55	19.04	7.68	5.21
Deltapine 16	40	795		37.6	5.86	1.15	.55	19.18	8.72	5.01
Deltapine 16	20	741	93	37.5	5.60	1.16	.56	19.40	8.36	4.94
Stoneville 7A	40	717		38.4	5.50	1.16	.56	18.80	6.12	5.15
Stoneville 7A	20	662	92	38.7	5.14	1.15	.55	18.94	6.10	5.02
Stoneville 7A Okra	40	668		37.7	5.29	1.14	.54	17.98	5.90	4.99
Stoneville 7A Okra	20	541	81	36.9	4.79	1.13	.54	18.30	6.20	5.02
Auburn M	40	642		34.9	6.12	1.11	.54	18.32	7.26	4.64
Auburn M	20	637	99	35.1	5.96	1.10	.54	18.92	7.26	4.73
ARK 61-28	40	612		34.2	6.67	1.06	.52	20.64	5.88	5.14
ARK 61-28	20	701	114	34.9	6.04	1.06	.53	20.76	5.94	5.20
Lockett 4789A	40	582		34.4	6.52	1.12	.56	19.96	6.72	4.78
Lockett 4789A	20	698	120	35.1	5.95	1.12	.55	19.74	6.98	4.60
Paymaster Dwarf	40	496		37.4	5.74	1.03	.53	19.34	8.44	4.74
Paymaster Dwarf	20	525	106	36.1	5.67	1.03	.50	19.82	8.46	4.92

Planted: May 6, 1970.

***Is the fiber strength of a bundle of fibers measured on the stelometer with the jaws holding the fiber bundle separated by a 1/8-inch spacer, expressed in grams-force per tex. Tex is the linear density of fibers, filaments, and yarns, expressed as the weight, in grams, of 1,000 meters of fiber or yarn.**

****Is the percentage elongation at break of the center 1/8-inch of the fiber bundle measured for T_1 strength on the stelometer.**

when grown in 15-inch rows. The lint yields of Stoneville 213, Deltapine 16, and 'Stoneville 817' were reduced 2, 3, and 2%, respectively, when grown in 15-inch rows, compared with 40-inch rows. In the 1971 study, 15-inch row plots were usually later in maturity than 30- and 40-inch rows. There were no consistent differences in maturity between 30- and 40-inch rows. Plant height was significantly reduced for 15-inch rows in 1971, but there was no significant difference in plant height for 30- and 40-inch rows. The highest yielding treatments in 1972 were Stoneville 213 grown in 30-inch rows and Coker 310 grown in 15-inch rows.

In 1972, lint yields were 4 to 19% higher when grown in 30-inch rows and 1 to 26% higher in 15-inch rows, compared to standard 40-inch rows (Table 3). Deltapine 16, Stoneville 213 and Coker 310 had 18, 9, and 4% increases in yield, respectively, when grown in 30-inch rows and 1, 4, and 2% yield increases, respectively, when grown in 15-inch rows. 'Stoneville 7A Super Okra Leaf' showed a 19 and 26% increase in yield, respectively, in 15- and 30-inch rows, but these yields were lower than those of the standard Delta varieties regardless of row spacing. There was very little difference in maturity between row spacings except that Deltapine 16 matured later when grown in 30-inch rows. The highest yielding treatment in 1972 was Deltapine 16 grown in 30-inch rows.

In 1973 lint yield of Delta varieties was 2 to 17% higher when grown in 30-inch rows and 6 to 19% higher when grown in 15-inch rows, compared to standard 40-inch rows (Table 4.). There were no consistent differences in maturity between 30- and 40-inch row spacings, but 15-inch rows matured significantly earlier than either 30- or 40-inch rows in 1973.

Three varieties (Stoneville 213, Deltapine 16, and Coker 310) were evaluated over a 3-year period (1971-73) when planted in 15-, 30-, and 40-inch rows (Table 5). The response of these Delta type varieties to narrow row production was inconsistent. The presence of a significant variety by year by location interaction for lint yield indicated that this type culture was very sensitive to environments

Table 2: Influence of row-spacing on five cotton varieties, Stoneville, Mississippi, 1971.

Variety	Row width	Lint Per Acre Total	Lint Per Acre First pick	Lint Per Acre First pick	Lint Per Acre 40-in. rows	Lint	Seed index	Boll size	Fiber Properties Length 2.5%	Fiber Properties Length 50%	Fiber Properties Strength*	Fiber Properties Elongation**	Fiber Properties Micronaire
	in	*lb*	*lb*	*%*	*%*	*%*		*Grams*			*g/tex*		
Stoneville 213	40	1112	889	80	---	[illegible]	11.4	5.78	1.12	.54	18.62	8.2	[illegible]
Stoneville 213	30	1222	987	81	110	38.9	11.3	5.74	1.14	.55	19.20	8.2	5.31
Stoneville 213	15	1086	752	69	98	38.4	11.2	5.37	1.12	.55	19.49	8.1	5.17
Deltapine 16	40	1088	942	87	---	38.5	10.9	5.90	1.15	.55	19.14	9.4	4.76
Deltapine 16	30	1168	1024	88	107	38.3	10.9	5.85	1.15	.55	19.85	9.5	4.66
Deltapine 16	15	1057	867	82	97	38.5	10.7	5.67	1.15	.55	19.70	10.0	4.66
Coker 310	40	1078	934	87	---	38.9	11.0	5.37	1.21	.56	19.67	7.5	4.64
Coker 310	30	1122	981	87	104	39.0	10.8	5.41	1.21	.57	20.11	7.3	4.69
Coker 310	15	1222	1051	86	113	38.9	10.8	5.29	1.20	.56	19.79	7.7	4.59
Stoneville 817	40	1031	840	81	---	36.3	11.2	5.31	1.09	.52	19.62	7.1	4.70
Stoneville 817	30	1090	887	81	106	36.7	11.5	5.23	1.11	.53	20.34	7.3	4.64
Stoneville 817	15	1010	786	78	98	35.8	11.1	5.21	1.11	.53	19.64	7.0	4.52
Lockett 4789A	40	837	687	82	---	33.6	13.6	6.64	1.15	.55	19.15	6.9	4.56
Lockett 4789A	30	954	768	80	114	33.6	13.4	6.48	1.14	.55	19.56	7.3	4.63
Lockett 4789A	15	871	714	82	104	33.7	13.6	6.14	1.14	.55	19.00	6.9	4.41

Planted: May 17, 1971. Harvested: October 13, and November 2, 1971. *See footnote, Table 1. **See footnote, Table 1.

Table 3: Influence of row-spacing on four cotton varieties, Stoneville, Mississippi, 1972

Variety	Row width	Lint Per Acre Total	Lint Per Acre First pick	Lint Per Acre First pick	Lint Per Acre 40-in. rows	Lint	Seed index	Boll size	Fiber Properties Length 2.5%	Fiber Properties Length 50%	Fiber Properties Strength*	Fiber Properties Elongation**	Fiber Properties Micronaire
	in	*lb*	*lb*	*%*	*%*	*%*		*Grams*			*g/tex*		
Stoneville 213	40	1239	827	67	---	40.0	10.5	5.54	1.12	.53	19.54	7.5	5.25
Stoneville 213	30	1288	818	64	104	40.5	10.3	5.48	1.11	.51	19.54	7.5	5.28
Stoneville 213	15	1290	868	67	104	40.9	10.3	5.30	1.12	.53	19.54	7.5	5.36
Deltapine 16	40	1106	690	62	---	40.0	10.8	6.22	1.15	.55	20.54	9.6	5.26
Deltapine 16	30	1306	621	48	118	39.9	10.9	6.20	1.13	.54	20.48	9.5	5.21
Deltapine 16	15	1119	627	56	101	40.0	10.7	5.79	1.13	.54	20.96	9.4	5.09
Coker 310	40	1178	710	60	---	39.8	11.4	5.91	1.21	.57	21.40	7.3	4.93
Coker 310	30	1286	777	60	109	39.8	11.2	5.62	1.20	.56	21.05	7.5	4.82
Coker 310	15	1199	775	65	102	40.5	11.0	5.33	1.19	.55	21.40	7.5	4.75
STV. 7A-S. Okra	40	926	635	69	---	40.1	9.7	5.09	1.10	.51	17.61	6.5	5.26
STV. 7A-S. Okra	30	1103	840	76	119	40.4	9.5	4.95	1.09	.50	17.67	6.4	5.17
STV. 7A-S. Okra	15	1163	832	72	126	40.5	9.8	5.03	1.09	.50	18.08	6.3	5.33

Planted: May 11, 1972 Harvested: September 21, and October 13, 1972. *See footnote, Table 1. **See footnote, Table 2.

Table 4. : Influence of row spacing on four cotton varieties, Stoneville, Mississippi. 1973

Variety	Row width	Lint Per Acre				Lint	Seed index	Boll size	Fiber Properties				
		Total	First pick	First pick	40-in. rows				Length		Strength*	Elongation**	Micronaire
	in	*lb*	*lb*	*%*	*%*	*%*		*Grams*	*2.5%*	*50%*	*g/tex*		
Stoneville 213	40	1130	795	70	---	40.6	10.9	5.68	1.14	.54	19.22	8.2	5.49
Stoneville 213	30	1210	840	69	107	41.2	10.8	5.57	1.13	.54	18.05	8.8	5.53
Stoneville 213	15	1200	1078	90	106	40.5	10.3	5.28	1.13	.54	18.25	8.5	5.39
Deltapine 16	40	966	626	55	---	40.6	11.1	6.07	1.17	.56	19.65	10.0	5.26
Deltapine 16	30	980	542	55	102	40.6	11.2	6.21	1.18	.57	19.80	10.0	5.41
Deltapine 16	15	1157	983	85	119	40.4	10.8	5.73	1.15	.54	19.25	9.9	5.26
Coker 310	40	938	534	57	---	42.0	11.3	5.90	1.21	.57	20.27	7.8	5.29
Coker 310	30	1099	680	62	117	42.9	11.1	5.65	1.20	.57	19.90	8.1	5.23
Coker 310	15	1102	959	87	117	41.6	10.6	5.34	1.20	.54	19.68	7.5	5.01
DES 2134-3	40	1018	712	70	---	39.1	11.0	5.56	1.19	.56	20.24	7.5	4.90
DES 2134-3	30	979	718	73	96	39.4	10.9	5.51	1.17	.55	20.36	7.6	5.07
DES 2134-3	15	1192	1015	85	117	39.0	11.0	5.22	1.17	.54	19.74	7.4	4.73

Planted: May 11, 1973. Harvested: October 4, and October 26, 1973. *See footnote, Table 1. **See footnote, Table 1.

Table 5: Influence of row spacing on three cotton varieties, Stoneville, Mississippi, 1971-73 average.

Variety	Row width	Lint Per Acre				Lint	Seed index	Boll size	Fiber Properties				
		Total	First pick	First pick	40-in. rows				Length		Strength*	Elongation**	Micronaire
	in	*lb*	*lb*	*%*	*%*	*%*		*Grams*	*2.5%*	*50%*	*g/tex*		
Stoneville 213	40	1160	837	72	---	39.8	10.9	5.67	1.13	.54	19.13	8.0	5.36
Stoneville 213	30	1240	882	71	107	40.2	10.8	5.60	1.12	.53	18.93	8.2	5.37
Stoneville 213	15	1192	899	75	103	39.9	10.6	5.32	1.12	.54	19.09	8.0	5.31
Deltapine 16	40	1053	752	71	---	39.7	10.9	6.06	1.16	.56	19.78	9.7	5.09
Deltapine 16	30	1151	729	63	109	39.6	11.0	6.08	1.15	.55	20.04	9.7	5.09
Deltapine 16	15	1111	825	74	106	39.6	10.7	5.73	1.14	.54	19.97	9.8	5.00
Coker 310	40	1065	726	68	---	40.3	11.2	5.73	1.21	.57	20.45	7.5	4.95
Coker 310	30	1169	813	70	110	40.6	11.0	5.56	1.20	.57	20.35	7.6	4.91
Coker 310	15	1174	928	79	110	40.3	10.8	5.32	1.20	.55	20.29	7.6	4.78
Average	40	1092b[1]	772	71	---	39.91a	11.05a	5.82a	1.17a	.56	19.78a	8.4a	5.13a
Average	30	1187a	808	68	109	40.12a	10.92a	5.75b	1.16ab	.55	19.77a	8.5a	5.12a
Average	15	1159a	884	76	106	39.97a	10.72b	5.45c	1.15b	.54	19.78a	8.5a	5.03b

[1] Means followed by the same letter are not significantly different at the 5% level of probability.

*See footnote, Table 1.

**See footnote, Table 1

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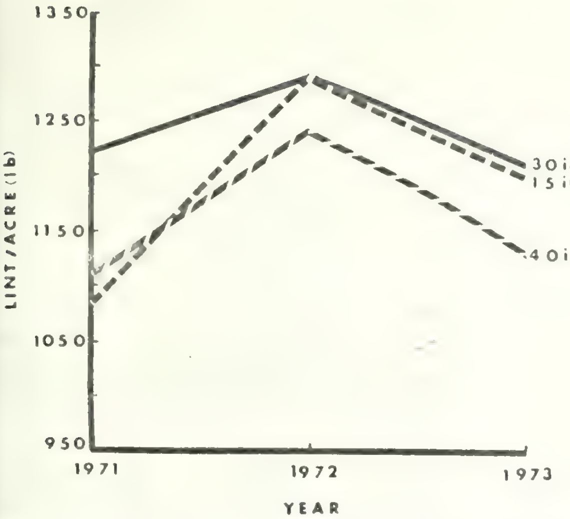

Figure 1. Average yield of Stoneville 213 planted in three row spacings, Stoneville, Mississippi, 1971-72-73.

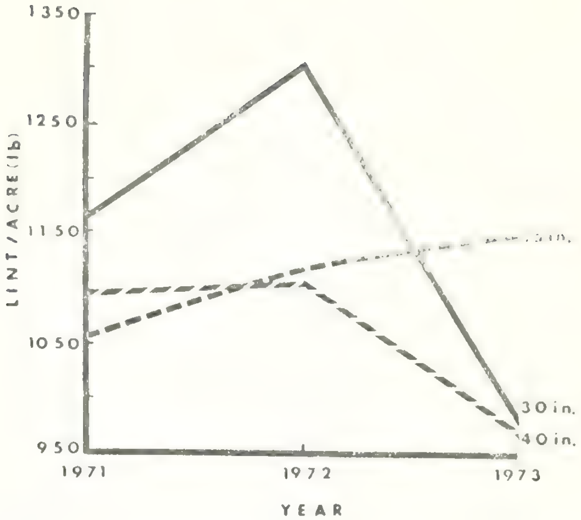

Figure 2. Average yield of Deltapine 16 planted in three row spacings, Stoneville, Mississippi, 1971-72-73.

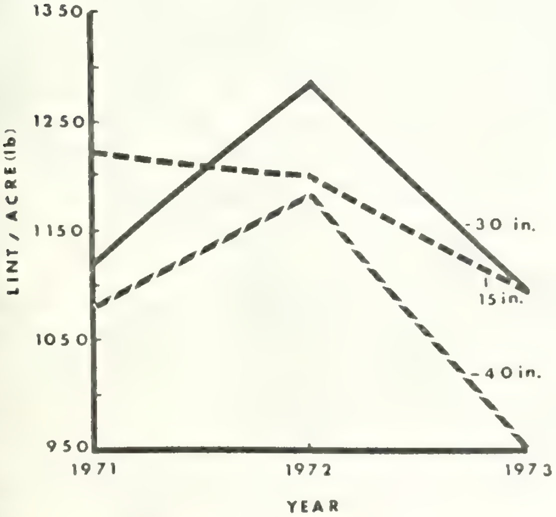

Figure 3. Average yield of Coker 310 planted in three row spacings, Stoneville, Mississippi, 1971-72-73.

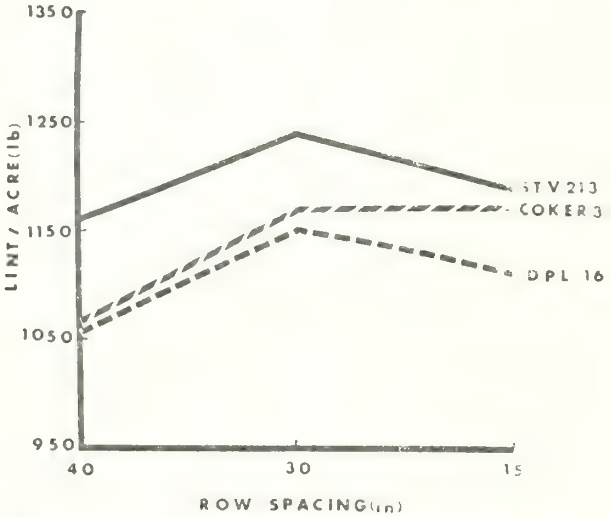

Figure 4. Average yields of three varieties of cotton planted in three row spacings, Stoneville, Mississippi, 1971-72-73.

gnificant variety by spacing and acing by year interactions were so measured. Briggs and Patter-n (3) reported that their studies ith narrow row spacings in cotton ve been inconsistent---a test in e year was not very comparable a test of another year. Wilkes and obgood (15) reported lower yields e year but equal yields the sec-d year from cotton grown in rrow rows. They also concluded that conventional varieties are not particularly adapted to narrow row production.

Our data also show that the response to different row spacings has been inconsistent (Figures 1-4). The performance of Stoneville 213 was more consistent than that of the other varieties tested. The highest lint yield of Stoneville 213 was obtained from the 30-inch row spacing in two of the three years. In 1972, the lint yield obtained from 30- and 15-inch rows was about equal. In two out of three years, the lint yield obtained from 15-inch rows was higher than that of 40-inch rows.

The response of Deltapine 16 to various row spacings was somewhat different, although in two of three years the 30-inch row spacing produced the highest yields. In 1971 and 1972, the

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highest yield response of Deltapine 16 was obtained from 30-inch rows, but in 1973 the yield response obtained from 15-inch rows was the highest. In 1971 and 1972, the lint yield obtained from 30-inch rows was higher than for either 15- or 40-inch rows. These data indicate that differences in environment play a major role in the response obtained from different row spacings.

The response of Coker 310 to different row spacings was different from that of Stoneville 213 and Deltapine 16. In all three years the lowest lint yield of Coker 310 was obtained from 40-inch rows, but 15- and 30-inch rows gave variable results. In 1971, the 15-inch rows produced the highest yields, in 1972 the 30-inch rows were higher yielding, and in 1973 the 15- and 30-inch rows produced equal yields, which again points out the role of environment in measuring differential responses.

The three-year average (1971-73) of our study shows that the lowest lint yield was obtained from 40-inch rows for all varieties. The lint yield of Stoneville 213 and Deltapine 16 was the highest when planted in 30-inch rows (7 and 9% increases, respectively) and decreased slightly in 15-inch rows (3 and 6%, respectively). The lint yield of Coker 310 was equal in 15- and 30-inch rows, showing a 10% yield increase over 40-inch rows (Table 5).

The combined response (1971-73) of all varieties (Table 5) shows that 30- and 15-inch rows gave 9 and 6% increases in yield, respectively, when compared to 40-inch rows. These data imply that 15-inch rows matured earlier than 40-inch rows, but this was the case in only one of three years. The difference was so large during one year (1973) that the overall average indicated earlier maturity.

Niles (8) reported that Deltapine Smoothleaf was nearly identical in yield and maturity in single row and double row culture (31,000 and 62,000 plants per acre). He concluded that relatively high populations offer a means for increased yields when used in conjunction with proper genotypes. Wilkes (14) reported on the comparison of two varieties, planted on two dates in two drill spacings, and found that yield of the conventional variety, Deltapine Smoothleaf, was not significantly affected or was slightly decreased when planted in close drills during the normal planting season (April 20). When planted 30 days later (May 20) the yield increased in closer drill spacings, when compared with 40-inch rows. Our studies were planted 1 to 2 weeks later than normal each year, which may have reduced yields in 40-inch rows as compared to the closer spacings.

Niles (9) reported on variety performance at two row spacings, (one drill on a 40-inch bed and two drills 10 inches apart on a 40-inch bed). The response of Deltapine 16 to increased populations was negligible---he reported a 1% increase in lint yield over 2 years. His greatest yield increase in each season was from experimental strains that averaged 12-37% more lint over a two-year period. Brown, Beaty, Ethridge, and Hayes (4) reported that irrigation affected the optimum plant population considerably, irrespective of row spacing in corn. Since a moisture stress is evident at a much earlier date for 15-inch row spacings in cotton, timely irrigations might increase yield.

The combined data (1971-73) of our study indicated that row spacing had no significant influence on lint percent, fiber strength, and fiber elongation. Bolls produced on 15-inch row plots were significantly smaller than those of 30- and 40-inch row plots. There was no significant difference in boll size between 30- and 40-inch rows for Stoneville 213 and Deltapine 16, but the bolls produced by Coker 310 became significantly smaller as the distance between rows was reduced.

There was no significant difference in seed index between 30- and 40-inch rows, but 15-inch row plots produced slightly smaller seed. Fiber produced in 40-inch row plots was significantly longer than that produced in 15-inch rows, although in most years this difference was very small. Micronaire values of 40- and 30-inch row plots were significantly higher than those of 15-inch row plots. Kirk, Brashears, and Hudspeth (7) found that fiber length was not influenced by row width, but that fiber strength was reduced as row width and space between plots were reduced. Their data also showed a successive trend toward micronaire reduction as row width and spacings between plants decreased.

These data suggest that evaluation of Delta type varieties in narrow rows is less consistent than evaluations in 40-inch rows. These data also imply that it is necessary to have a relatively large number of environments to adequately evaluate the varietal response to several row spacings.

The potential for narrow row cotton production appears to vary between cotton growing areas. To the present time, yield results have been inconsistent.

One of the major obstacles in realizing the full potential of narrow row culture is the lack of special genotypes or varieties adapted to this type of production. In most studies it has been concluded that conventional varieties are not particularly adapted to narrow rows.

It has been suggested that narrow row culture may reduce production costs under certain circumstances. This potential will have to be evaluated on an area basis, since production systems and environments vary drastically across the Cotton Belt.

ese results do indicate a poten- for narrow rows, but suggest variety evaluation is more dif- t and requires more testing our usual variety evaluations.

The transfer to a narrow row production system would require the producer to replace or modify much of his field equipment. These conversions should be undertaken only when there are significant increases in yield or significant reductions in production cost.

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Bulletin 817

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Management and Production Practices for Control of Insect Pests in Grain Sorghum

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Management and Production Practices for Control of Insect Pests in Grain Sorghum

Grain sorghum (*Sorghum bicolor* L. Moench), commonly referred to as milo, is an important feed grain in Mississippi. Mississippi imports about 50,000,000 bushels of this and other grains annually. Grain sorghum yields compare favorably with corn in both quantity and quality, and low production costs for sorghum combined with its drought tolerance make it attractive to growers, particularly in a double crop system following early small grains.

Two major problems encountered in the production of grain sorghum have tended to suppress its production in Mississippi. One of these problems is the high moisture content at harvest and the other is loss of the crop to insects. This publication is a report of a study of the management of insects that attack the sorghum grain head and of crop production practices that affect insect populations.

The Sorghum Grain Head

The grain head of sorghum is a panicle or compound racemose inflorescence, with hundreds of individual spikelets that are of two types, sessile and pedicellate. The latter usually contains only anthers or male parts. Each of the sessile spikelets contains an ovary, usually three anthers, and a bifurcated feathery stigma enclosed in a pair of closely-fitting shuck-like covers or glumes. At the time of blooming (flowering), the glumes open and the yellow male pollen-bearing anthers protrude but are held to the structure by fine filaments leaving the pollen-receptive tips of the female pistil exposed.

Blooming of a sorghum head usually takes about a week. The first blooms appear at the top or apex of the head. Each day more blooms appear lower down the head, and so on for about a week when the last blooms occur at the base of the head. Therefore, the first blooms at the top of the head are about 7 days older than those at the base.

After fertilization the small pinhead-sized ovary develops into a seed at the base and within the glumes. About the time that all of the head has completely bloomed, the grains maturing at the top of the head become large enough to force open the glumes and the upper tips of green seeds can be seen. A wave of such seed protrusion then moves down the head day-by-day, proceeding as did the blooming. Soon the seeds at the top of the head begin to turn in color (red, yellow or brown) depending on the color that the mature grain will be. As the seeds turn color, they develop to a "milk" stage, pass through a "dough" stage, and eventually harden. All these stages proceed in the wave-like fashion described for blooming and setting of seed.

Major Insect Pests

In Mississippi, the three major insects that attack sorghum heads differ greatly in classification, appearance and behavior, but they share the trait of being able to destroy sorghum grain efficiently and in a quiet, unnoticed way. Two of these species are so commonly found on sorghum and its grass relatives that their common and scientific names are compounded from the word sorghum, while the third pest is shared with plants of many kinds.

The sorghum midge, *Contarinia sorghicola* (Coquillett), is a small orange-bodied, gnat-like fly or Diptera in the family Cecidomyiidae (Figure 1). Adults of this insect do not damage sorghum, but they deposit eggs that develop into small legless maggots within the glumes. These maggots feed on the fertilized ovary, causing the seed to fail to develop.

The sorghum webworm, *Celama sorghiella* (Riley), is a small moth or Lepidoptera of the family Nolidae. Eggs are laid on sorghum heads and the hairy larvae (Figure 2), frequently in large numbers, feed on the seeds while they are soft and green.

The corn earworm, *Heliothis zea* (Boddie), also known as the cotton bollworm, sorghum headworm, or tomato fruitworm, is a medium-sized moth or Lepidoptera of the family Noctuidae. The eggs laid on the heads of sorghum produce larvae (Figure 3) that feed on the grain in all stages of its development.

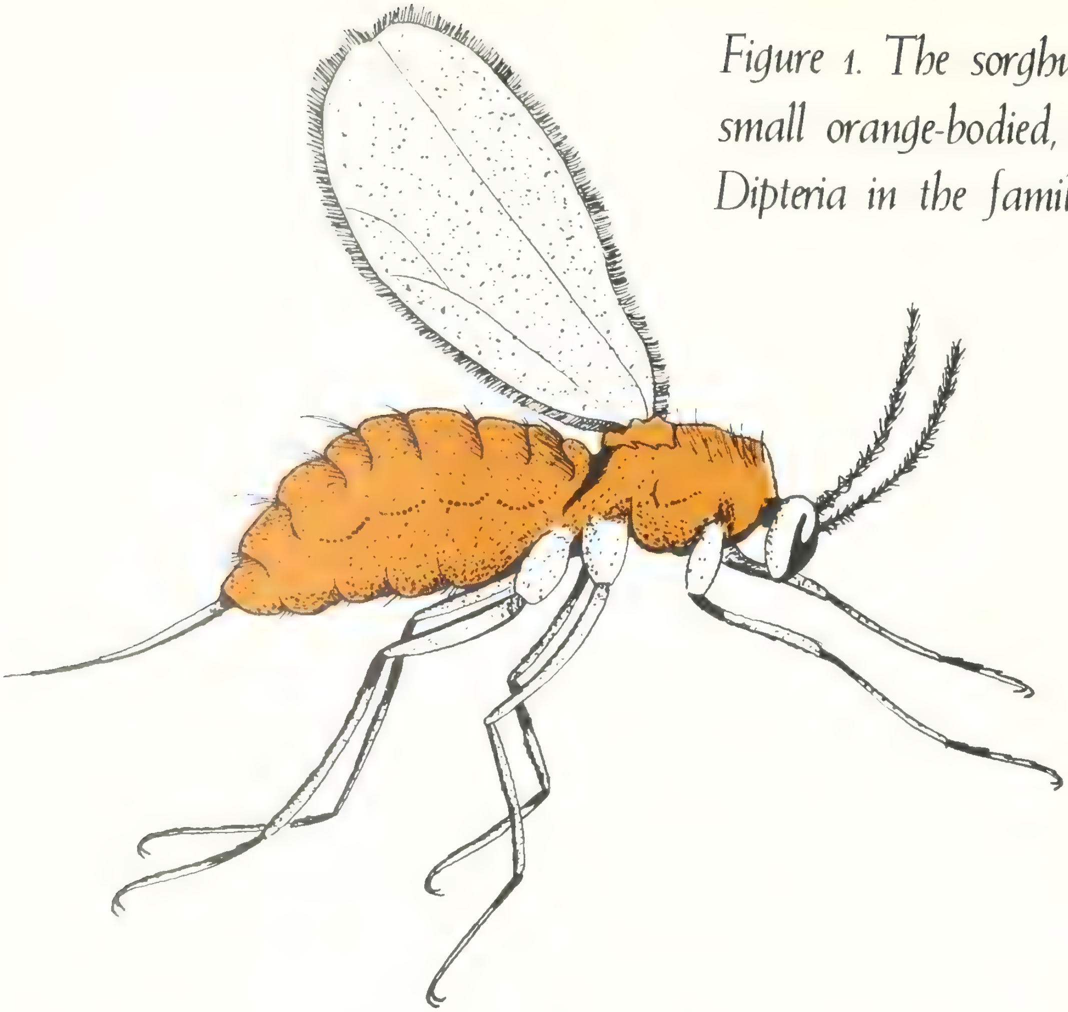

Figure 1. The sorghum midge---a small orange-bodied, gnat-like fly or Dipteria in the family Cecidomyiidae.

These larvae usually are found in small numbers. Open panicle varieties of sorghum are usually less damaged by this insect than are the compact panicle varieties.

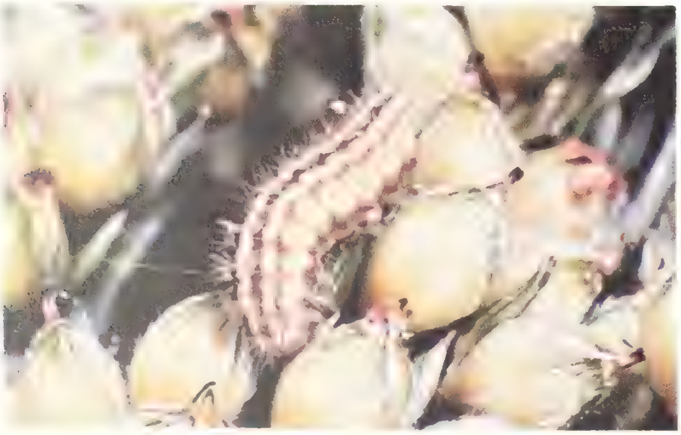

Figure 2. The hairy larvae of the sorghum webworm (above), Celama sorghiella.

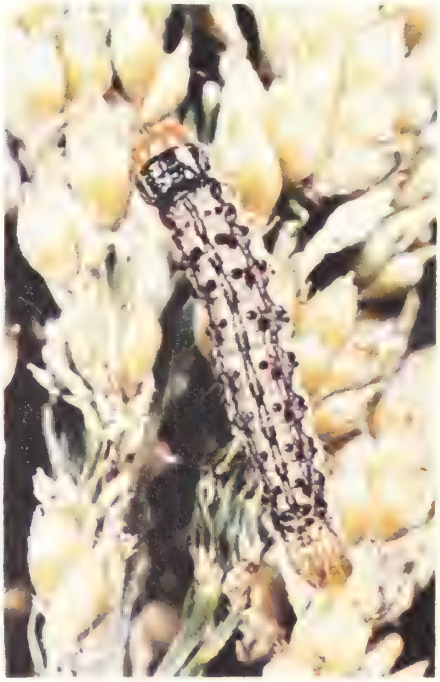

Figure 3. The larvae of the corn earworm, Heliothis zea, also known as the sorghum headworm.

The Sorghum Field Agro-ecosystem

The current trend in agriculture is to produce large acreages of a single crop species (species homogeneity or monoculture). The result is a highly unstable ecological situation that often allows crop pests to become an economic factor in production.

The problem of species homogeneity is true for most crops and they, too, suffer the common fate of overly-simplified agro-ecosystems. However, some crops may be produced in small acreages (e.g., vegetables) to lend species heterogeneity, or they may develop largely in cooler weather when many insects or other pest species are inactive (e.g., wheat). Others may have high unit value and thus be worthy of insecticide programs (e.g., cotton).

Grain sorghum must be classed with other grains as a low unit-value crop, where a schedule of routine insecticide applications for crop protection generally is considered to be uneconomical. Also the crop is grown in warm weather and is subject to damaging insect attacks that can totally limit production.

Grain Sorghum Tolerance to Insect Attack

Grain sorghum, like many other plants, produces many more seeds than it can efficiently mature. This results in a diminution of fruit size. Removal of 10% of the blooms or seeds of a sorghum head has no significant effect either on seed size or on grain yield. And at seed head losses as high as 25%, there is no reduction in grain yield because the remaining seed are so much larger. But, despite the large increase in seed size, grain yield is reduced significantly when as much as 50% of the seed head is removed (Table 1). This illustrates an important concept in grain sorghum insect pest management—that limited seed losses, particularly in the earlier stages of development, are not reflected in an equal reduction in grain yields.

This same effect was studied further and it was found that, though seed loss compensation was greatest in the earlier stages of development, it was still quite measurable in the "dough stage". Thus losses caused by earworms as grain approaches maturity are offset, at least partly, by larger seeds.

Indirect Grain Sorghum Losses Attributable to Insect Attacks: In addition to the actual insect feeding losses on the grain, there may be:

1. Head rot,
2. High-moisture grain that results in;
   - (a) moisture dockage at the market, or
   - (b) higher drying costs, or
   - (c) harvest delays that result in;
     - (1) weathering losses,
     - (2) exposure to bird damage and
     - (3) exposure to stored grain pests.

Head rot of grain frequently is associated with earworm or webworm damage. Where there is damage to the heads, the worm excrement in the head and/or the webs causes conditions favorable to head rotting or molding.

High-moisture grain is usually more serious than head rot. It occurs more frequently when there is only a small planting or where there is poor uniformity in fruiting for any of several reasons mentioned elsewhere. It may be caused by any of the three major insect pests—webworm, earworm or midge, and damage is greatest when part of the field is early, or when there are other nearby earlier fields to supply a heavy population of egglaying insects.

When insect damage to a sorghum plant results in less than a rather full grain head, the plant usually responds by putting out several tillers either from the ground or from an upper node, each with a smaller grain head. These heads usually are 3 to 4 weeks or more later than the parent plant. The resulting delay in harvest increases the probability of weathering loss, bird damage and further insect damage.

Table 1.—Compensatory response of seed size in grain sorghum following mechanical removal of 10%, 25%, or 50% of an individual head in the bloom stage or immature seed stage.

Item	Amount of head removed	Seed yield	Seed mass
	Percent	gm/head	gm/1000
Control	0	39 a[1]	26 a[1]
Bloom	10	34 ab	28 a
Seed	10	39 a	28 ab
Bloom	25	33 abc	30 bc
Seed	25	28 abc	31 c
Bloom	50	24 bc	36 d
Seed	50	26 c	37 d

[1] Means followed by the same letter are not significantly different at the .05 level of probability, as determined by Duncan's new multiple range test.

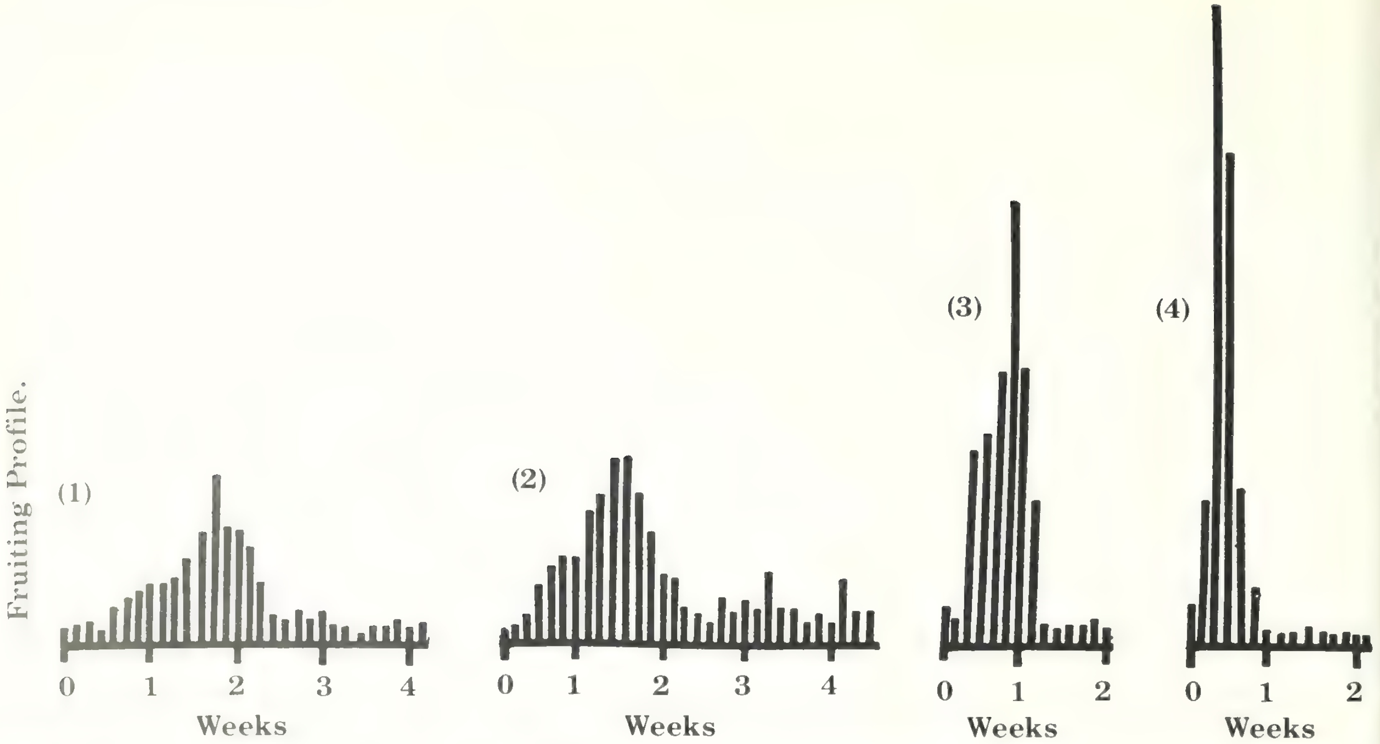

Figure 4. Fruiting profiles of some large grain sorghum fields in the Mississippi Delta in 1958 and 1961. (1) and (2)---Poor uniformity, with fruiting occurring over more than 4 weeks, resulting in almost total loss of the crop to insects, particularly field reared midge. (3) and (4)---Excellent uniformity, with little or none of the crops exposed to field reared midge in the short 2-week fruiting period, resulting in good to excellent yields of high quality grain that was harvested early for optimum seed quality.

Grain Sorghum Fruiting

The importance of uniformity of grain sorghum fruiting cannot be overemphasized. A cycle of insect buildup resulting in seed losses can begin with poor fruiting uniformity. The insect most likely to cause these losses is the sorghum midge, since it requires only about 12-18 days to complete a generation.

Large acreages of grain sorghum planted over a period of several weeks usually result in almost complete crop failure of the later planted acreage. This is illustrated by fruiting profiles of typical fields of grain sorghum in the Mississippi Delta (Figure 4). Fields with uniform fruiting had excellent yields of high-quality grain. A virtual total loss of crop to insects was observed for fields with poor fruiting uniformity and even the use of insecticides would not have prevented serious crop losses.

Practices For Control of Insects

Most of the factors that affect uniformity of fruiting can be handled by proper planning and good crop management. Some of the more important of these are:

Time of planting---early planted sorghum crops usually escape large populations of grain-damaging insects. Also, insects do not have to be a limiting factor in production from later plantings, given proper planning for insect pest management. A small-plot field study in Oktibbeha County in 1972 revealed the importance of planting early to escape large populations of the sorghum midge at crop bloom. Sorghum planted April 28 received less than 1% seed damage (Table 2). Small acreages planted on different dates suffered severe damage---15%, 55% and 98% seed damage, respectively, occurred in sorghum planted on May 19, June 23 and July 13. This same effect occurs when poor crop uniformity in a field results in high field-reared midge populations.

Varietal characteristics---some varieties have variable seedling

Table 2.—Sorghum midge damage on grain sorghum planted on different dates in small field plots, Oktibbeha County, 1972.

Planting date	Average midge/head	Seed loss
	Number	Percent
April 28	—[a]	1
May 19	167	15
June 23	192	55
July 13	311	98

[a] Not numerically recorded, but observed to be very low.

vigor and this results in uneven crop maturity. Planting varieties that do not have this trait helps to alleviate the problem of poor fruiting uniformity.

Soil uniformity---delaying planting on heavy, non-uniform soils allows time for earlier insect populations to subside. Heavier soils frequently can be planted successfully under the normally drier summer conditions.

Seedbed preparation---this management aspect often is related to soil uniformity, and lack of stand uniformity on heavier soils frequently results in part from poor seedbeds. On any type of soil, however, good seedbed preparation results in more uniform plant populations.

Uniform fertilization---proper application of recommended fertilizers aids in growing a uniform crop. Lack of nitrogen delays fruiting.

Proper seeding rate---higher plant populations in a row generally lead to more uniform fruiting. Isolated plants in a "skippy" row tend to be large, "wolfy" and late fruiting, often with side shoots bearing later fruiting heads.

Soil moisture at seeding---a uniform stand requires adequate soil moisture at seeding time. If planting is done in dry soil, it should be dry enough to preclude any germination until there is a rain to wet the soil. However, this is a dangerous practice since a light shower can start germination and still leave the soil dry beneath the plants.

Biology and Control of Insect Pests on Grain Heads

The Corn Earworm: The corn earworm is a native insect that attacks sorghum in the leaf whorl and grain head stages. This insect survives the winter in a pupal or resting stage in the soil and emerges in the spring as a variably colored moth about ¾ inch long. It has many host plants, including vetch, alfalfa, tomato, corn, sorghum, soybean, and cotton. There are several generations a year and the insect may move from one host to another to lay eggs. The larvae are of different colors, mostly green or brown, and have several stripes along their sides and backs. In warmer weather the larval stages last about 2 weeks, and a new generation of moths appears about every 30 days.

Under most conditions small larvae appear in the heads in the early green seed stage and complete their development at about the time most of the seeds in a sorghum head reach a hard dough stage. Very small worms do not eat much, and it is mostly in the last several days of their development that most seeds are destroyed. Under most circumstances, infested heads of sorghum have only a single earworm in them since their numbers are regulated by cannibalism as the larvae develop and move about encountering others of their kind.

Sorghum varieties with open-branched heads favor the effectiveness of natural regulating factors, particularly predatory natural enemies of the eggs and immature larvae, as well as allowing the worm excrement and frass to fall from the head, thus avoiding some rot conditions in the heads.

Selected insecticides approved for use on sorghum and applied as a directed spray provide good to fair control of corn earworms on grain sorghum heads (Table 3). In general, the normally-occurring infestations of this pest in fields of uniform bloom do not usually decrease yields. This is in part due to the limited number of larvae per head and the seed size compensation noted earlier.

Large fields of a uniformly-fruiting, open-headed type of grain sorghum generally do not suffer yield losses due to this pest.

The Sorghum Webworm: The sorghum webworm has a limited host range relative to that of the earworm and seems to be limited to johnsongrass and various sorghum and sorgo crops. The adults are whitish moths only about ½ inch long and have distinctive tufts of scales on the forewings.

Unlike the corn earworm, the sorghum webworm larvae feed into the seeds and hull them out and frequently may be seen in large numbers (in excess of 200 larvae per head) on individual sorghum heads. The larvae are about ½ inch long, are spindle shaped, are brown and white striped and bear a thin coat of long hairs. They spin a thin webbing of silk in the head. This catches excrement and frass and may cause even open-headed varieties to have rot problems in the head.

The sorghum webworm does not seem to be able to increase as rapidly on johnsongrass as it does on sorghum heads, but in some years when large hay meadows of johnsongrass are allowed to mature heads, usually as a result of poor haying weather, large populations can result. When this occurs, or when a series of sorghum plantings in an area have headed over a long period, a serious outbreak may result. Webworm outbreaks are usually in late summer or in the early fall. The sorghum webworm also produces a new generation about every 30 days and large populations develop when there are available sorghum heads to build up on. Large populations are capable of causing extensive damage.

Sorghum webworms are apparently easily killed with insecticides approved for use on sorghum, when applied as a directed spray (Table 3).

Table 3.—Insecticide control of insects on grain sorghum planted on June 23, 1971, Oktibbeha County, Mississippi.

Treatment[1]		Insects/16 heads			
Insecticide and formulation	Rate	Sorghum webworm	Corn earworm	Sorghum midge damage	Head Yield
	(lb/A)	Number		% seed loss	g dry matter/ 20 heads
ethion 4EC*	0.50	1.50 abc[2]	7.50 abcde	43.5 a	899 a
ethion 4EC*	0.25	1.25 abc	12.75 de	44.4 ab	884 a
leptophos 3EC	0.50	0.50 ab	3.50 abc	54.7 bc	817 abc
azinphosmethyl 2EC	0.50	0.75 abc	5.50 abcd	55.5 c	894 ab
diazinon 4EC	0.50	2.00 abc	11.50 cde	57.3 cd	811 abc
leptophos 3EC	0.25	1.25 abc	5.00 abcd	58.0 cd	749 abc
methomyl 90% WP	0.50	0.009 a	0.00 a	61.5 cd	786 cd
disulfoton	0.50	6.25 cd	7.50 abcde	66.5 de	653 cd
disulfoton	0.25	15.40 f	9.25 bcde	72.5 ef	662 cd
azinphosmethyl 2EC	0.25	1.25 abc	6.75 abcde	72.9 ef	801 abc
diazinon 4EC*	0.25	7.50 de	13.25 de	74.5 efg	852 ab
carbaryl 80% WP*	0.50	3.75 abcd	3.00 ab	77.4 fgh	676 c
carbaryl 80% WP*	0.25	5.8 bcd	6.7 abcde	80.3 fghi	503 e
malathion 57% EC*	0.25	0.8 abc	5.3 abcd	81.0 fghi	698 bc
dimethoate 2EC	0.25	1.3 abc	12.8 de	83.6 ghi	481 e
dimethoate 2EC	0.50	4.5 abcd	10.0 bcde	84.5 ghij	509 e
methomyl 90% WP	0.25	4.8 abcd	7.8 abcde	86.1 hij	657 cd
malathion 57% EC*	0.25	11.8 ef	14.5 e	90.9 ij	667 cd
Untreated		49.5 g	47.5 f	95.1 j	225 f

***Material labeled for use on grain sorghum for sorghum midge control (WP = wettable powder; EC = emulsifiable concentrate).**

[1] Insecticide spray applied when 75% of the plants were in early bloom (August 19); second application 5 days later (August 24).

[2] Means followed by the same letter are not significantly different at the .05 level of probability as determined by Duncan's new multiple range test.

The Sorghum Midge: The sorghum midge is thought to be from Asia, but is now a widespread pest of grain sorghum in the United States. This insect overwinters in an immature stage in sorghum head and johnsongrass head residues and usually emerges as an adult before grain sorghum heads are in a bloom stage. During the early-season generations they usually infest johnsongrass heads near the site of their overwintering. The midge adults are feeble fliers and have a short life span. Males usually live only a few hours and females live only 1 or 2 days. The small, gnat-like orange-bodied adult midge is about 1/16 inch long and can be seen on or hovering near blooming sorghum heads, since the females lay their eggs between the glumes at the time of blooming.

For practical purposes, there is a new generation of adult sorghum midge each two weeks. The larvae develop next to the developing seed near the base of the glumes and pupate between the glumes. The pupae move up to the tip of the glumes as they near the time for adult emergence. At the time of emergence they move up until the pupal case is left hanging from the tip of the glumes. These pupal cases can often be seen bristling from heavily infested heads.

The seed in an infested glume fails to develop and where there is a complete loss of seeds, the sorghum heads have a typical, slim compact look (Figure 5). Where there is less than complete seed loss, there may be a scattering of oversized seeds. When there is an abrupt reduction of midge adults in the field due to insecticide use or some other factor temporarily reducing the midge population to a low level, it has been noted that heads may have their tops slim and compact and their bases full of seeds.

The sorghum midge, when present in large numbers may completely destroy small plantings or late portions of highly nonuniform fields. Large fields of grain sorghum planted early and fruiting in a highly uniform manner usually receive only limited seed loss which is compensated for by larger seed.

Light infestations of sorghum midge on early-planted, uniform stands of grain sorghum do not require insecticide controls. Late planted sorghum may be vulnerable to damaging midge populations that build up in the surrounding area. In fields with a midge problem or where the pest is detected in large numbers during early fruiting, a preventive insecticide spray program may be required to protect the crop during the bloom period. Several insecticides (Tables 3 and 4) currently available for use against the sorghum midge are effective in preventing seed head losses[1]. Insecticides should be applied on a 3- to 4-day schedule, beginning when 10% of the plants begin to bloom. The cost of insecticide treatments can be reduced by using the lower rates indicated in Table 4. These are as effective as the higher rates in a preventive spray program where the blooming grain head receives 3 spray applications at 4-day intervals. When insecticides are used, crop uniformity may shorten the time that insecticide protection is needed.

Table 4.—Evaluation of insecticides for control of the sorghum midge on sorghum planted June 28, 1972, Oktibbeha County, Mississippi.

Insecticide and formulation[1]	Rate	Visual estimate of midge damage
	(lb/A)	% seed loss/head[2]
diazinon 4EC*	0.10	17.7 a
leptophos 3EC	0.25	19.7 a
phosalone 3EC	0.50	19.9
ethion 4EC*	0.25	20.4 a
leptophos 3EC	0.50	20.7 a
diazinon 4EC*	0.25	21.6 a
oxydemetonmethyl 3EC	0.50	22.6 a
Sevimol® 4EC*	1.00	24.3 ab
ethion 4EC*	0.10	25.0 ab
phosalone 3EC	0.25	26.2 abc
disulfoton 6EC	0.50	29.4 bc
carbaryl 80% WP*	1.00	32.2 bc
disulfoton 6EC	0.25	35.9 cde
oxydemetonmethyl 3EC	0.25	45.4 def
dimethoate 2EC	0.10	45.9 ef
dimethoate 2EC	0.25	48.0 f
Untreated		70.1 g

***Material labeled for use on sorghum for midge control.**

[1] Insecticide applied on September 5 when 10% of the crop was initiating bloom, and on September 9 and 13.

[2] Means followed by the same letter are not significantly different at the .05 level of probability as determined by Duncan's new multiple range test.

Conclusions

Good management and crop production practices can minimize insect damage as a limiting factor in grain sorghum production. Insect pests are more destructive on small, late-planted and large nonuniform plantings. A good crop under such conditions requires the use of insecticides. Cultural practices, including selection of land, land tillage, crop rotation, and timeliness of planting for uniformity of bloom are probably the most important crop production practices for reducing insect damage.

The possible need for insecticides on grain sorghum must be determined and may be based on acreage planted, crop uniformity, and insect pest populations. Knowledge that sorghum in an area is annually attacked by specific insect pests may be justification for a preventive insecticide spray program. On the other hand, close observations of the crop during the growing season, to determine damaging insect pest populations, may be used in deciding the need for insect control.

Nevertheless, the choice of insecticide is important for greatest efficiency in control of specified pests. Also, rates and method of application are critical. Identification of the insect pest is of primary importance. Insecticides are not all equally effective against all pests. It should be borne in mind that the use of insecticides for midge control while the plant is in the bloom stage kills natural enemies of the earworm and may result in the need for a control program directed at this pest.

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[1] *Diazinon, ethion, malathion, carbophenothion, and carbaryl currently have labels for use on grain sorghum for control of the sorghum midge in Mississippi.*

Spray applications of insecticides for midge control, beginning at 10% bloom stage and at 3- to 4-day intervals during blooming, is critical, if spraying is needed. Low dosages of insecticides can be utilized effectively in a spray program to control the sorghum midge. Insecticide dosages higher than those recommended should be avoided. Excessive use of insecticides results in resistance in insect populations. If insecticides are used judiciously, insect pest management includes the conservation of natural populations of beneficial arthropods in the field.

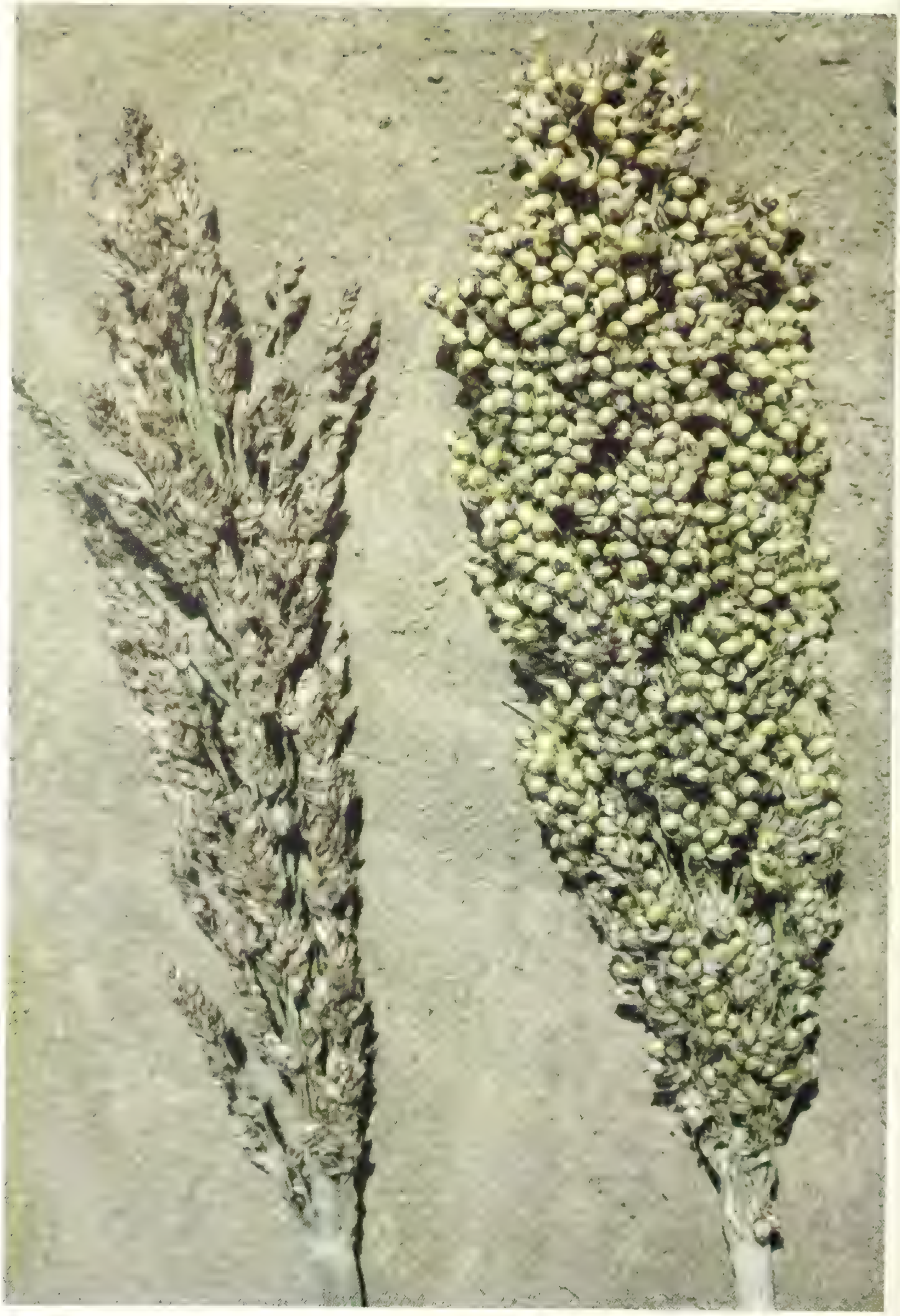

Figure 5. A midge-damaged head (left) and a healthy sorghum head.

FEEDING GIN TRASH TO BEEF CATTLE

By J. W. Holloway
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W. A. Pund
W. D. Robbins
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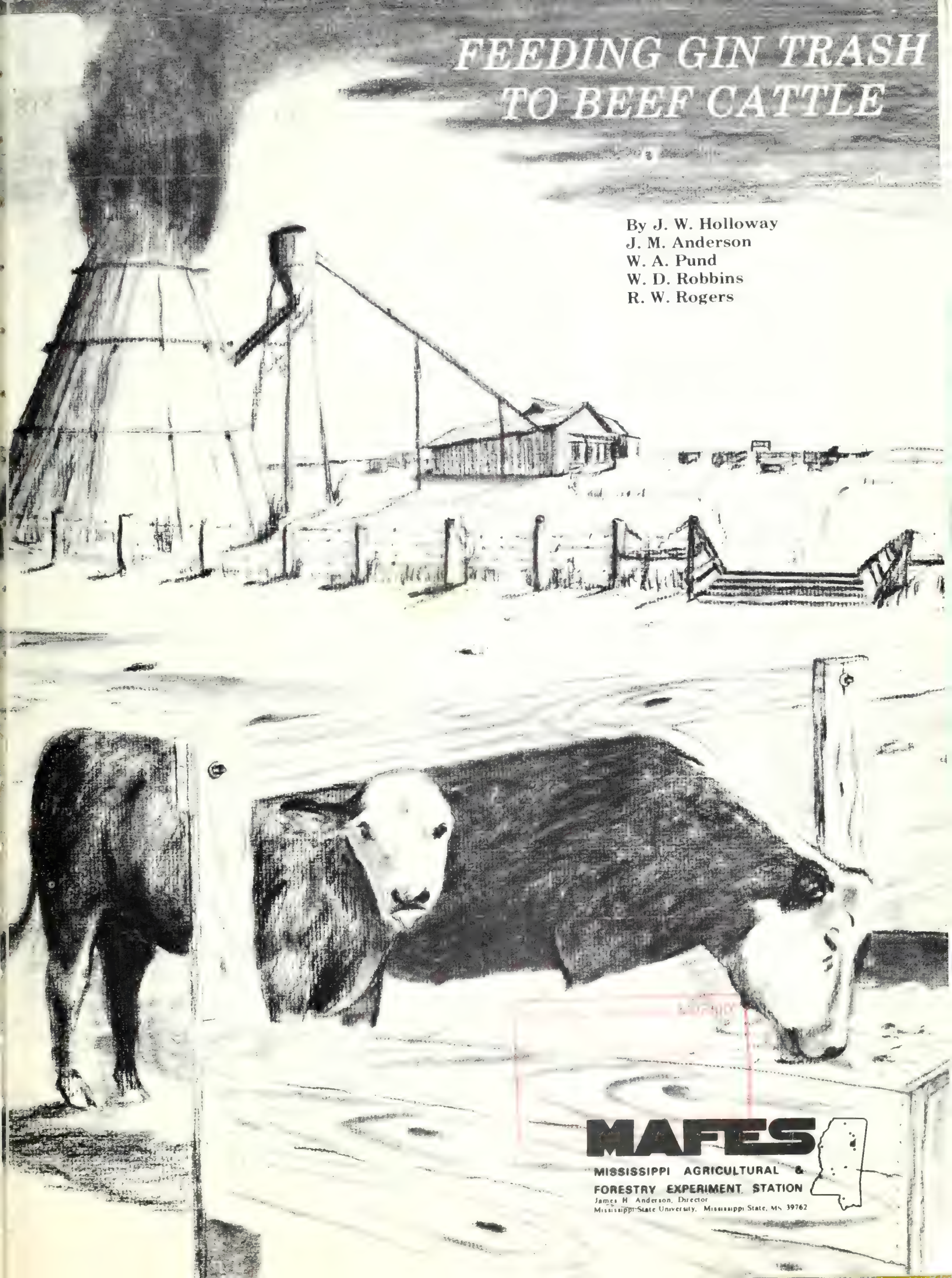

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The initial research to evaluate the feasibility of utilizing gin trash as a feedstuff for beef cattle was partially supported by a grant from the Southern Ginners Association, Memphis, Tennessee.

Bulletin 818

FEEDING GIN TRASH TO BEEF CATTLE

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October 1974

FEEDING GIN TRASH TO BEEF CATTLE

Recent laws for environmental protection have increased interest in economical means for disposing of gin trash. Disposal methods that prevent atmospheric contamination with dust and smoke and the contamination of cropland with weed seed and disease-producing organisms are needed.

Pelleted gin trash from stripper-harvested West Texas cotton is considered to be approximately nutritionally equivalent to cottonseed hulls. Mississippi Delta gin trash has been shown to possess some nutritional value (Essig, 1964; Morrison, 1972; and Anderson, *et al*, 1973). Gin trash from picker harvested Mississippi Delta cotton is much higher in motes (cellulose) than is that of stripper harvested West Texas cotton and a higher nutritive value of Mississippi gin trash appears probable. Anderson *et al.* 1973, however, found that cattle fed pelleted Mississippi gin trash grew at approximately the same rate as cattle fed pelleted West Texas gin trash.

The major problem with feeding gin trash to cattle is the possibility of animals becoming unfit for human consumption as the result of accumulation of pesticide residues in animal tissues.[1]

The purpose of the research reported herein was to determine the feasibility of utilizing gin trash as a wholesome source of available energy for finishing steers.

Materials and Methods

A study utilizing trash in a growing ration for steers was initiated in December 1972. Thirty steers were studied in three phases: Phase 1, a 125-day experimental period; Phase 2, a 207-day summer growing period; and Phase 3, a 75-day finishing period. During all phases steers were allowed free access to trace mineralized salt. All steers were fed once daily and daily comsumption was recorded except for steers on pasture.

Phase 1---The study was designed to compare the results of feeding gin trash with those of feeding intermediate sorghum silage (DeKalb variety FS-24 to which 0.5% Limestone had been added at the time of ensiling). The steers were allotted by weight and breed to five groups. All steers were fed 0.9 pound of cottonseed meal/head/day plus free choice intake of different additional feedstuffs for each group (treatments 1 through 5):

Treatment 1. Sorghum silage.

Treatment 2. Sorghum silage and gin trash.

Treatment 3. Gin trash plus 4 pounds of ground corn/head/day.

Treatment 4. Gin trash.

Treatment 5. Gin trash plus 3 pounds of ground corn/head/day with 2 pounds of activated charcoal/head/day added in an attempt to reduce absorption of DDT.

Phase 2---The steers were removed from the experimental feed lot and randomly allotted within treatment to either a Coastal Bermudagrass pasture or a slab-floor feedlot. The steers in the feedlot were allowed free choice intake of high-cut corn silage (harvested six inches below the ear) to which 0.5% urea and 0.5% limestone had been added at the time of ensiling.

Phase 3---All steers were placed in a slatted-floor feedlot and fed the same finishing ration (Table 1).

Steers were weighed monthly and at the beginning and end of each phase. Perianal fat biopsies also were taken at the beginning and end of each phase by administering a local anesthetic to produce spinal blockage, removing from 2 to 10 grams of fat tissue and closing the incision with a stitch.

All steers were slaughtered in a commercial packing plant at the end of the 75-day finishing period. Postmortem perianal fat samples

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[1] As a result of changes in regulations regarding its use, DDT may now be a less important problem. However, during the period of the research (1972-73) DDT residues were a major concern.

Table 1. Finishing Ration of Steers Fed Experimental Rations for 125 Days.[1]

Feedstuff	As Fed Basis	D.M. Basis
	- - -Percent- - -	
High Cut Corn Silage ensiled with 0.5% urea and 0.5% limestone	30.27	14.88
Ground #2 shelled corn	61.54	74.80
Cottonseed Meal (41% crude protein)	7.69	9.61
Limestone	0.50	0.70

[1] Experimental Rations Were:
Treatment 1. Sorghum silage.
Treatment 2. Sorghum silage and gin trash.
Treatment 3. Gin trash plus 4 pounds of ground corn/head/ day.
Treatment 4. Gin trash.
Treatment 5. Gin trash plus 3 pounds of ground corn/head/day and 2 pounds of activated charcoal/head/day.

were taken from the chilled carcasses and a liver sample was taken within 1 hour after slaughter. Fat and liver samples were frozen and stored in glass jars at -15°F until chemically analyzed.

Fat and feed samples were analyzed for DDT, DDD, DDE, Dieldren, Aldrin, Toxaphene and Methyl parathion. Feed and liver samples were analyzed for elemental arsenic. Carcass data were obtained with the cooperation of a USDA meat grader.

One steer was removed from the test because of sickness not attributable to treatment. General emaciation of some steers at the end of the gin trash feeding phas made it impossible to obtain adequate fat samples. Missing dat were estimated and statistica analysis was accomplished b procedures outlined by Steel an Torrie (1960).

Results and Discussion

Feed Chemical Analyses---Gin trash pesticide residues varied markedly between sites with DDT levels ranging from 2.59 to 6.53 ppm and toxaphene ranging from 7.77 to 18.34 ppm (Table 2). This is in agreement with Anderson *et al* (1973). Of the other feedstuffs used in this study cottonseed meal with 0.36 ppm elemental arsenic was the only one with more than token levels of pesticide residues. The arsenic levels in gin trash were substantially lower than values reported by Miller (1973) for Texas gin trash.

Table 2. Pesticide Content of Feeds[1] in Experimental, Growing and Finishing Rations.

Feed	DDT	DDD	DDE	Toxaphene	Arsenic
			ppm		
Gin Trash Site 1	3.80	0.00	0.37	15.00	0.65
Gin Trash Site 2	6.53	0.00	0.38	18.34	0.69
Gin Trash Site 3	2.59	0.11	0.25	7.77	0.49
Sorghum Silage	0.12	0.20	0.05	1.61	0.08
Corn Silage	0.02	0.22	0.02	0.00	0.12
Cottonseed Meal	0.01	0.00	0.00	0.00	0.36
Shelled Corn (#2)	0.01	0.00	0.01	0.00	0.11

[1] As fed dry matter basis.

The proximate analysis of gi trash (Table 3) indicates potentia nutritive value with 30.5% nitroge free extract (soluble carbohydrate 3.5% ether extract (fat, oils, an pigments) and 10.2% crude protei (N x 6.25). However, it containe 39.7% crude fiber (insoluble ca bohydrate), components of whic may be chemically or physicall combined with the more solubl components causing reduce nutritive value.

Feed Consumption an Conversion---Steers fed corn grai consumed more dry matter tha other steers; steers in othe treatments consumed simila amounts of dry matter (Table 4 Steers fed rations composed mostl of gin trash were less efficient i conversion of dry matter to gai ble 3. Proximate Analysis of Feeds[1] in Experimental, Growing and Finishing Rations.

ed	Water	Ash	Crude Protein	Crude Fiber	Ether Extract	Nitrogen Free Extract
				%		
n Trash Site 1	9.93	11.83	8.51	34.65	3.35	30.75
n Trash Site 2	7.60	5.23	11.91	43.00	3.85	28.39
n Trash Site 3	7.13	5.90	10.10	41.45	3.15	32.28
rghum Silage	67.50	—	2.55	7.53	—	—
gh Cut Corn Silage	60.60	—	3.98	7.90	—	—
ttonseed Meal	8.50	6.58	46.75	9.40	1.63	27.15
elled Corn (#2)	10.68	1.73	9.60	4.23	4.82	68.97

s fed dry matter basis.

ble 4. Daily Feed Consumption of Steers on Experimental Rations.

	Treatment[1]									
	1		2		3		4		5	
	As Fed	Dry	As Fed	Dry	As Fed	Dry	As Fed	Dry	As Fed	Dry
					Pounds					
ermediate orghum Silage	28.5	9.3	12.2	4.0	—	—	—	—	—	—
n Trash	—	—	6.3	5.8	8.2	7.6	9.7	8.9	8.9	8.2
ttonseed eal (41% CP)	0.9	0.8	0.9	0.8	0.9	0.8	0.9	0.8	0.9	0.8
Shelled orn	—	—	—	—	4.1	3.7	—	—	3.1	2.8
tivated harcoal	—	—	—	—	—	—	—	—	1.1	1.1
tal	29.4	10.0	19.4	10.6	13.2	12.2	10.6	9.7	14.0	12.9

e Footnote, Table 1.

ble 5. Feed Efficiency of Steers on Experimental Rations.

	Treatment[1]				
m	1	2	3	4	5
d efficiency during perimental phase DM/lb weight gain	8.55	9.64	10.70	32.33	16.75
d intake during perimental phase DM/100 lb steer eight	2.18	2.34	2.67	2.39	2.76

e Footnote, Table 1.

(Table 5). This was especially true for steers fed gin trash plus cottonseed meal only. Steers on the charcoal, gin trash, corn ration required more dry matter for weight gain than did steers on the gin trash, corn ration. The poor efficiency of conversion of gin trash dry matter to weight gain indicates either poor digestibility or poor utilization of digested nutrients. Our results suggest that gin trash, when supplemented with 0.9 lb. of cottonseed meal has about one fourth the value, on a dry matter basis, of the variety of intermediate sorghum fed as silage.

Steer Performance---Daily gain during the experimental phase was generally poor (Table 6), and was much lower* for steers receiving gin trash as the only major energy source than for steers in other treatments. Differences between daily gain in other treatments in the experimental phase were not statistically significant but a trend existed for steers receiving larger proportions of their diet as gin trash to gain at a slower rate. The lower gains for steers receiving gin trash resulted in lighter weights at the end of the experimental phase (Table 6).

Although no differences were detected in daily gains in the summer growing phase, steers previously fed gin trash or gin trash plus corn tended to gain more rapidly than did steers fed sorghum silage or sorghum silage and gin trash.

Steers fed only gin trash and cottonseed meal during the experimental phase were apparently permanently "stunted", resulting in decreased final weight. This was also reflected in reduced daily gain when calculated over all phases. Daily gains of other treatments were similar.

Carcass Characteristics---Carcass grades ranged from USDA high good to USDA low choice (Table 7) The only carcass characteristic influenced importantly by treatment was warm carcass weight, with lighter carcass weights evident for steers fed only gin trash plus cottonseed meal.

**Differences between treatments noted here and elsewhere in this report are all statistically significant at the 5 percent probability level. This means that differences as large as those reported could have occurred by chance only 5 times in 100 trials.*

Table 6. Performance, by Study Phases, of Steers Fed E perimental Rations.

	Treatment[1]					
	1	2	3	4	5	SE
Initial Weight, lb.	384^{b}	384^{b}	384^{b}	386^{b}	383^{b}	5.1
Weight at End of Experimental Phase, lb.	531^{b}	523^{b}	528^{b}	424^{c}	481^{bc}	15.
Daily Gain Experimental Phase, lb.	1.17^{b}	1.10^{b}	1.14^{b}	0.30	0.77^{b}	0.
Weight at End of Growing Phase, lb.	791^{b}	749^{b}	812^{b}	710^{b}	769^{b}	29.
Daily Gain Growing Phase, lb.	1.26^{b}	1.09^{b}	1.37^{b}	1.38^{b}	1.39^{b}	0.
Slaughter Weight	987^{b}	980^{b}	996^{b}	865	973^{b}	18.
Daily Gain Finishing Phase, lb.	2.33^{b}	2.75^{b}	2.20^{b}	1.85^{b}	2.44^{b}	0.
Daily Gain Over all Phases, lb.	1.44^{a}	1.43^{a}	1.47^{a}	1.15	1.41^{a}	0.

[1] See footnote, Table 1.

[a] Standard error =Average amount by which each treatm mean differs from the true mean.

[bc] Means within a row not followed by a common letter dif (P<.05) from one another.

Table 7. Carcass Characteristics of Steers Fed Experimen Rations

	Treatment[1]					
Characteristic	1	2	3	4	5	SE
Warm Carcass Weight, lb.	577^{ef}	545^{fg}	590^{e}	512^{g}	580^{ef}	10.
Marbling Score^{b}	4.85^{e}	5.22^{e}	5.48^{e}	4.70^{e}	5.27^{e}	0.
Quality Grade, USDA^{c}	11.5^{e}	12.2^{e}	12.3^{e}	11.5^{e}	12.3^{e}	0.
Loin Eye Area, sq. in.	10.4^{e}	10.2^{e}	10.6^{e}	10.2^{e}	9.6^{e}	0.
Fat Thickness, in.	0.50^{e}	0.50^{e}	0.43^{e}	0.38^{e}	0.58^{e}	0.
Yield Grade^{d}	3.22^{e}	3.13^{e}	3.03^{e}	2.80^{e}	3.75^{e}	0.

[1] See footnote, Table 1.

[a] Standard Error Average amount by which each treatm mean differs from the true mean.

[b] 4 = slight; 5 = small; 6 = modest

[c] 10 = average Good; 11 = high Good; 12 = low Choice; average Choice; 14 = high Choice.

[d] Calculated percent boneless, trimmed round, rib, loin chuck; 2 = 52.3%; 3 = 50.0%; 4 = 47.7%.

[efg] Means within a row not followed by a common letter di (P<.05) from one another.

ticide Levels in Steers and Steer casses---Initial levels were ilar for all steers and were erally relatively low (Table 8). lysis of the fat samples taken the end of the experimental se revealed significant build- of DDT and DDE, but only for tments 1, 2 and 4. Steers fed y gin trash as the major energy rce experienced the greatest in- se in concentrations of these pesticides and adding charcoal to the gin trash/corn ration did not reduce absorption of pesticides significantly. Levels of Dieldrin and DDD did not change significantly during the experimental phase and no samples taken contained Endrin, Toxaphene or Methyl Parathion, either at the end of the experimental phase or at the end of subsequent phases.

Amounts of DDT, DDD, and DDE in all fat samples obtained at the end of the growing phase were well below the levels permitted for human consumption (Table 9).

The levels of pesticides in the fat from all steers were lower at the end of the finishing phase than at the beginning of the experiment. Amounts of elemental arsenic in liver samples did not differ significantly among treatments and were far below established tolerance levels.

Summary

eers fed gin trash as the major rgy source gained at slower s than did those fed sorghum silage or gin trash supplemented with sorghum silage or ground corn. The steers started on gin trash did not overcome this early deprivation in the growing and finishing phases and reached lighter slaughter weights, yielded lighter carcasses and tended to have less backfat thickness and lower yield grades than did steers started on the other experimental rations. Average rates of gain over all phases of the study, slaughter weights, and carcass characteristics of steers started on gin trash plus other sources of energy were similar to those of steers started on rations containing no gin trash.

Higher levels of gin trash in the experimental rations were associated with increased retention of DDT and DDE in the fat of steers. Addition of charcoal to the gin-trash/corn ration did not reduce absorption of pesticides significantly. Samples taken at the end of each phase of the study contained no Endrin, Toxaphene or Methyl Parathion.

All fat soluble pesticide amounts were below established tolerance levels at the end of the growing phase and were far below both initial amounts and tolerance levels when the steers were slaughtered 407 days after experimental feeding was begun.

The liver content of elemental arsenic ranged from .06 to .12 ppm and was far below tolerance levels for all rations tested.

ble 8. Pesticide Levels, By Study Phase, of Steers Fed Eximental Rations.

	Treatment[1]					
	1	2	3	4	5	SE[a]
ial Levels[b], ppm						
DT	1.06^{d}	1.08^{d}	0.60^{d}	0.88^{d}	1.21^{d}	0.433
DD	1.79^{d}	3.01^{d}	1.75^{d}	3.06^{d}	4.09^{d}	1.192
DE	3.95^{d}	10.28^{d}	3.56^{d}	6.28^{d}	9.07^{d}	3.290
els at End of perimental Phase[b], ppm						
DT	0.59	3.32	4.15^{d}	8.23	6.37^{d}	0.709
DD	2.22^{d}	6.80^{d}	6.35^{d}	8.03^{d}	3.48^{d}	0.933
DE	6.85^{d}	16.53^{ef}	12.97^{de}	25.57	13.48^{d}	2.844
eldrin	0.02^{d}	0.04^{d}	0.02^{d}	0.00^{d}	0.03^{d}	0.014
els at End Growing Phase[b], ppm						
DT	0.06^{d}	0.76^{d}	0.49^{d}	0.24^{d}	0.56^{d}	0.216
DD	0.00^{d}	0.02^{d}	0.02^{d}	0.00^{d}	0.00^{d}	0.014
DE	1.59^{d}	5.30^{d}	4.22^{d}	3.10^{d}	2.31^{d}	0.988
eldrin	0.06^{d}	0.02^{d}	0.01^{d}	0.02^{d}	0.01^{d}	0.010
els at End Finishing Phase[b], ppm						
DT	0.05^{d}	0.22^{d}	0.27^{d}	0.11^{d}	0.33^{d}	0.091
DD	0.00^{d}	0.00^{d}	0.00^{d}	0.00^{d}	0.00^{d}	0.000
DE	1.01^{d}	2.33^{d}	1.83^{d}	1.23^{d}	1.39^{d}	0.485
eldrin	0.00^{d}	0.02^{d}	0.02^{d}	0.01^{d}	0.01^{d}	0.010
S[c] (elemental)	0.11^{d}	0.09^{d}	0.12^{d}	0.06	0.09	0.036

[1] See footnote, Table 1.

[a] Standard Error = Average amount by which each treatment differs from the true mean.

[b] DDT, DDD, DDE, and Dieldrin values refer to levels in rianal adipose tissue.

[c] Elemental AS values refer to levels in liver.

[ef] Means within a row not followed by a common letter differ >.05) from one another.

Table 9. Tolerance Residue Levels of Pesticides

Pesticide	Tissue or Plant	Tolerance Level
		ppm
DDT	Bovine Fat	7
	Cottonseed	4
	Corn Grain	0
	Corn Forage	0
	Sorghum Grain	Not listed
	Sorghum Forage	Not listed
Dieldrin	Bovine Fat	Not listed
	Cottonseed	Not listed
	Corn Grain	0
	Corn Forage	0
	Sorghum Grain	0
	Sorghum Forage	0
Aldrin	Bovine Fat	Not listed
	Cottonseed	Not listed
	Corn Grain	0
	Corn Forage	0
	Sorghum Grain	0
	Sorghum Forage	0
Endrin	Bovine Fat	Not listed
	Cottonseed	0
	Corn Grain	Not listed
	Corn Forage	Not listed
	Sorghum Grain	Not listed
	Sorghum Forage	Not listed
Toxaphene	Bovine Fat	Not listed
	Cottonseed	Not listed
	Corn Grain	7
	Corn Forage	Not listed
	Sorghum Grain	5
	Sorghum Forage	Not listed
Methyl Parathion	Bovine Fat	Not listed
	Cottonseed	0.75
	Corn Grain	1
	Corn Forage	1
	Sorghum Grain	Not listed
	Sorghum Forage	Not listed
Arsenic	Bovine Liver (uncooked)	2
	Cottonseed	Not listed
	Corn Grain	Not listed
	Corn Forage	Not listed
	Sorghum Grain	Not listed
	Sorghum Forage	Not listed

Source: Code of Federal Regulation. 1973. Food and Drug Administration. Parts 35 and 40, Paragraphs 180.147, 180.131, 180.121, 135.33, 180.137, 180.135 and 180.138.

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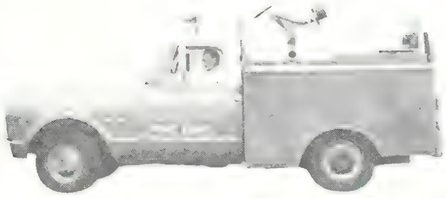
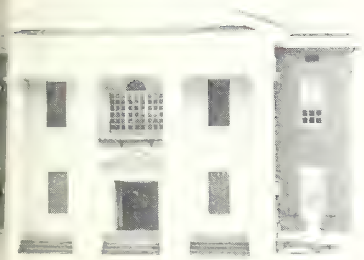
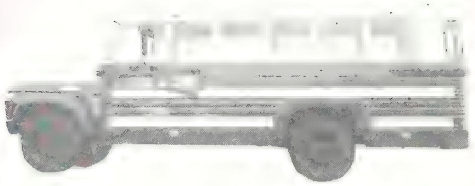
February 1975

A Letter To Mr. & Mrs. Taxpayer







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Bulletin 819

A Letter To Mr. And Mrs. Taxpayer

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Preface

The Department of Agricultural Economics of MAFES and of the College of Agriculture o Mississippi State University has a modest research effort under way in the area of taxation The focus of this effort is to provide information to help acquaint the citizens and public officials of Mississippi with the current situation, some of the alternatives available, and th likely effect of these alternatives.

The intent of this publication is to introduce a planned series of publications on taxation b sharing with readers the experiences of other states and the opinions of tax authorities a abstracted from the literature. *Its contents should by no means be construed as recommendations*

The second publication of the series is now being printed as MAFES Bulletin 820. Th authors, Agricultural Economist Fred H. Tyner and former Graduate Assistant Jerry W Grace, explore *the effect of property assessment equalization on county revenues, millage rates an homestead exemption.*

Two MAFES Bulletins to be published in the near future will present the results of studies o *farmland property taxes based on use-value assessment* and *the economic aspects of alternatives to th property tax as a means of financing public education.* Associate Agricultural Economist James H Simpson and former Graduate Assistant Stanley A. Herren conducted the research on *use-valu assessment;* Agricultural Economist Fred H. Tyner and former Graduate Assistant Fred D Robertson studied the *means of financing public education.*

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A LETTER TO MR. AND MRS. TAXPAYER

You have for some time now been osing some extremely difficult nd important questions about the roperty tax. The problems with hich you are concerned are not eculiar to your own county or comunity; other counties and comunities in Mississippi and in all ther states have similar problems nd an increasing number of conerned citizens throughout the Naon are posing the same or similar uestions.

The growing public interest in hat I choose to call the "Property ax Crisis" has generated nominal upport for taxation research and as led to tax seminars in a number f states. Unfortunately, the hard-ore facts essential to solving the roblems surrounding the property ax either have not been deterined or have not been assembled nto a format designed to provide he answers needed. Published eminar proceedings and research esults do, however, provide useful uidelines for those seeking ways o improve the property tax.

Three basic questions must be nswered in providing and finaning public services:

1. *Which public services should logically be provided by local, state and Federal governments in sparsely populated areas, in metropolitan areas and in the country in-between?*
2. *What level of spending is necessary to provide "adequate" facilities and services?*
3. *How should the cost of public services be allocated among citizens of the community, state and nation?*

Our approach to answering these uestions has been to call upon all evels of government to meet itizens' expanding public service emands. Through the political process, we have created a very complex federal system with many units of government and a host of elected and appointed public officials. Responsibility for supplying and financing public services is shared among these governments through a wide variety of programs and techniques. Stresses have developed which threaten the system but which will lead to major changes, especially in methods of financing public services. (9, pp. 2 & 3)*

Real property taxation undergirds but is only part of the whole of local government revenues. The complexity of the tax structure becomes apparent when one takes real property taxation in the cities, towns and 82 counties of the State and combines it with the multiple government revenue-sharing programs financed by excise, sales and income taxes.

Meeting the public interest of quality education and other public services raises a fundamental question: *How to adjust the over-all tax structure of the state and local governments to provide more equitable taxation, including real property taxation, in response to social and economic adjustment from a changing technology,*

—the car

—the industrial park

—the shopping center, and

—the shifting comparative advantage of land uses, especially against the intensively used inner city area and the extensively used farm and open space lands? (7, p. 10)

Some of the more important issues involved in adjusting the over-all tax structure may be posed as questions:

1. *Where should money needed to support the local government work-load come from? The property tax? Other local taxes? If so, what taxes? Local fees and charges? State aid? Federal aid? Other sources?*
2. *Are there too many or too few local governments to tax and spend efficiently in response to public demand? If so, how should they be changed?*
3. *Can and do local governments collect taxes as fairly and efficiently as the state or Federal Governments?*
4. *Can they perform their functions or work-load as productively and responsively to public demand as the state or Federal Government? How could they improve?*
5. *Should the state or Federal Governments take over and administer more, or less, of the local work-load, such as education, highways, welfare? How would this affect local, state and national taxes?*
6. *Where should state money come from to support state operations and state aid to local government?*
7. *How could state governments be improved?*
8. *Where should Federal money come from to support Federal operations and Federal aid to states?*
9. *How could the Federal Government be improved?* (6, p. 4)

Turn now to the question, what are the requirements of a "good tax"? To some people the only "good tax" is a tax somebody else will pay. I do not believe that this reflects the attitude of most taxpayers. Your statement that farmers expect to pay taxes but do not want to be abused is, in my judgment, a fair assessment of the feeling of taxpayers generally. Resistance to local and state tax increases does, however, arise when

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**Numbers in parentheses refer to the sources of quotations used in this letter. This one, for example, refers to pages 2 and 3 of reference number 9 of the Literature Cited at the end of the letter.*

taxpayers believe that they bear more than their fair share of the cost of government, that they receive relatively few of the public services provided by their tax dollars, or that their tax burden is grossly unrelated to their ability to pay.

Suggested sets of criteria for evaluating tax measures have been with us at least since Adam Smith's famous canons: Equity, certainty, convenience and economy. These canons are still relevant nearly 200 years later, if interpreted carefully. One of the better modern interpretations that I have come across states that a good tax system should:

> *(1) Distribute the cost of government with reasonable fairness among all people who receive benefits from government services and who have taxpaying ability;*
>
> *(2) Be readily understood by the taxpayer and as convenient for him to pay as possible;*
>
> *(3) Be relatively easy to administer to minimize administrative complications;*
>
> *(4) Be difficult to evade or avoid;*
>
> *(5) Provide adequate revenue for the needs of local, state, and Federal Government;*
>
> *(6) Be flexible enough to meet changing conditions;*
>
> *(7) Be widely shared;*
>
> *(8) Interfere as little as possible with the private production of wealth.* (6, p. 4)

People always have strong opinions about their taxes, opinions that reflect what they see in their coummunity. *Over time these opinions become beliefs—judgments considered facts. An increasing number of people hold these beliefs about the real property tax:*

- *That it is neither closely related to public service benefits received nor ability to pay.*
- *That it often has a detrimental effect on land use.*
- *That it is poorly administered.*
- *That it is being overworked.*
- *That it does not meet the equity norms established for public finance. To wit:*
  - *A tax should be just.*
  - *It should be levied in accordance with the ability to pay.*
  - *It should be difficult to evade.*
  - *It should be uniformly applied within classes.*
  - *It should be clearly spelled out in laws.* (7, p. 4)

The property tax has long been condemned as a "poor" tax. Its weaknesses have been well summarized by Ronald Welch: "*—The property tax is the most unpopular of all major taxes now employed in the United States. It is under attack from all sides. It is denounced by welfare economists as our most regressive major tax, by businessmen as our most inflexible tax, by farmers as our most unfair tax, by the aged as our tax least related to ability to pay, by guardians of the law as our most ineptly administered tax, and by conscious or instinctive disciples of Henry George as our most repressive tax. Despite these inherent weaknesses, it will not be abandoned so long as local governments exist. Improvements in its administration, although possible and desirable, cannot make this a 'good' tax in terms of accepted principles of public finance.* **In my opinion, its use should be restricted primarily to property-related services but not so narrowly defined as to exclude activities which maintain or increase property values, e.g., paying off bonds for certain capital improvements."** (9, pp. 6 & 7. I added the emphasis because I heartily concur.)

The central problem in real property taxation is the capacity of the tax to provide adequate revenue to finance minimum needs of a community, whether city, town or county. *Equitable and efficient taxation requires that a state-local revenue sharing system reflect some maximum limit on property taxation. A system m be developed that will take into count and reflect changes in so and economic developme Moreover, it must provide amount of revenue adequate finance an acceptable level quality public services in all lo governments. Such a system wo equitably serve people in our ci and our most rural counties.* (7 23)

Professor Donald Epp has sa *My suggestions that foll are not addressed to the immedi problem of farmers faced w rapidly increasing property burdens. Rather, I am suggesti some ideas that may provide fo for thought on how we might tack the general problem that gi rise to the specific problem of hi taxes on farmland.*

First, I would suggest shifti services that are national statewide in nature to funding a administration at the national a state levels. Because of the gre geographic mobility of people day, education and welfare are vious candidates for state national financing and a ministration. This, of course, do not preclude local administrati offices and advisory bodies. suggests only that these servic are not a strictly local responsibi ty and should not be financed strictly local taxes.

Second, where a governmental provided service is obvious oriented to serve a specific group should be financed by user charge An example of such a service is municipal water supply agency. (pp. 85 & 86)

Virtually all tax economist recommend shifting support local schools to consumption an income taxes. A strong argumen can be made for this. Why, for in stance, should a rural propert owner bear a disproportionat share of the cost of educating rura youth, when, for the most part, it i e better equipped young people ho leave rural areas for the cities? an a childless home owner be ex- ised for wondering if his share of e tax burden is fair, when public lucation is the chief use of proper- tax revenue?

Like it or not, major reforms in nancing of public schools appear the offing. The Advisory Com- ission on Inter-Governmental elations, in its Tenth Annual eport, commented prophetically the issue of reforming school nance to assure equality of lucational opportunity: *"Quite ossibly, judicial intervention ther than gubernatorial or state gislative leadership, will prove to e the vital ingredient in this—one f the most critical of the urban rises. A veritable revolution in cal government structure and nancing in the United States ould ensue if the judiciary should dopt the doctrine that every pupil hould have substantially the me fiscal backing—or in the case f the disadvantaged youngster— ubstantially more."* (9, p. 7)

The judiciary has done just that. he California Supreme Court has **eld that financing public chools by heavy reliance on cal property taxes "makes e quality of a child's educa- ion a function of the wealth of is parents and neighbors and enies 'equal protection' under e 14th Amendment to the U. . Constitution."** (9, p. 7)

The California case is among ver 20 cases to be brought before e Courts. Of these, a Texas case, a innesota case and a New Jersey ase have been decided. Plainly ut, the ruling in the Minnesota ase was that **the level of spen- ing for a child's education ay not be a function of wealth ther than the wealth of the tate as a whole.**

In March of 1973, the U. S. upreme Court overturned the wer court ruling in the Texas ase, which was similar to the rulings in the California and Minnesota cases, *finding that the Texas system of school finance did not violate the equal protection clause of the 14th Amendment. It seems likely that the effect of this decision will be to transfer the issue to the State Legislatures.* (12, p. 20)

Subsequent to this ruling, other state courts have handed down rulings similar to those in California, Minnesota, and Texas. Clearly, equal fiscal backing for education is not yet a dead issue and many State Legislatures find that they have a knotty problem on their hands. *Options being considered among the states include: (1) statewide property tax, or pooling and redistribution of local property tax revenue; (2) greatly expanded state aid from sales and income taxes; and (3) transfer of local school taxes from wealthy to poorer districts.* **People in rural areas should realize that the first option would shift a part of urban school costs to farm property.** (9, p. 7, emphasis added)

The greatest opposition to divorcing support for local schools from the property tax comes from those who fear the loss of local control of schools. *Ample evidence is available to indicate that local control of the local public school system is considerably less than local people believe it to be. Moreover, local control is not denied by the recent court decisions. The Court stated in Van Dusartz "if the state chooses to emphasize local control, it remains free to do so to whatever degree it wishes."* (8, p. 13)

With reference to special property tax exemptions the Advisory Commission on Intergovernmental Relations has commented: *"The states have long had a propensity, which is continuing, to fritter away the property tax base by concealing subsidies, in the form of special tax exemptions to promote private causes of questionable importance..."* (3, p. 33)

Legislation granting special property tax exemptions involves states in property tax administration. In my opinion, this is an area in which states should not be involved but one in which they will continue to be involved so long as they must reimburse local governments for revenue lost as a result of exemptions. For example, even though the state government of Mississippi now levies only a four mill tax on all taxable property in the state, the State Tax Commission has the duty to see that the assessments of the various classes of property in the several counties of the state are reasonably equal and uniform throughout the state and that all property is assessed as nearly as possible at its true value.

Professor Harry Case has written: *Mississippi's laws regarding taxation of property, if followed, are certainly adequate to bring about uniform and equal taxation throughout the state. The major questions that should be asked at this point are* **whether uniformity and equality should be the major criteria** *and, if so, are our laws being administered in a manner that brings about such uniform and equal taxation. Obviously, a field study will have to be conducted to answer the latter question.* (2, p. 5, emphasis added)

The most readily identifiable major tax subsidy in Mississippi is the Homestead Exemption. While, in the eyes of many, criticism of the Homestead Exemption is tantamount to an attack on the sanctity of motherhood, others feel that the Homestead Exemption is archaic and needs to be eliminated. If it is decided that some relief be granted to some groups of taxpayers (the elderly, for example) the relief could take the form of a **credit** against state income tax liability.

Advantages to be gained from the income tax credit approach include the following: The subsidy can be limited to those who finan-

cially need it. The cost of the subsidy is borne by the state government which granted the subsidy. The state government is able to utilize other tax sources than the property tax more efficiently than local governments. The tax base of financially hard-pressed local governments is maintained intact. Inequities between local governments caused by the unequal impact of property tax exemptions are avoided. Finally, it would enable the legislature to more accurately compare the costs of the subsidy with the benefits that might be derived. A more intelligent social policy decision would be possible. (3, p. 35)

Granting local governing bodies the authority to impose a local sales tax has serious implications for the property tax. The dense settlement pattern associated with cities and towns has been and still is giving way to a *less dense settlement pattern, called suburbia. There settle the young, the advantaged, the affluent, the new industry and the shopping center...*

. . .

Shopping centers seek customers from places other than suburbia, and they succeed. People drive out from the city and in from the rural areas to shop at the "biggest shopping center in the region"...

. . .

Both cities and rural areas subsidize suburbia through the sales tax. To offset the tax revenues transferred by citizens carrying on normal business activity, the city or the county or both may find it necessary to impose higher taxes on real property.

. . .

Suburbia creates other problems. Local county government is called upon to supply many urban-type public services to their new population, including education for their rapidly increasing school age population.

. . .

To meet their obligations, affected counties make huge investments in public facilities and incur large increases in operating expenditures.

. . .

Such counties have witnessed rapidly rising land values and enormous additions of structures. Despite this, per capita expenditures for public services have risen to heights where dependence upon the real property tax strains near the breaking point.

. . .

As this strain intensifies, so does discussion about equity and real property taxation. An extreme diversity of opinion is expressed, with newly settled suburbanites and long-time resident landowners arriving at different conclusions about the equity issue. Long-time residents do not believe their land should bear the cost of public services that new residents demand and local governments provide. (7, pp. 13, 14, 15, & 16)

The Mississippi Constitution provides that property shall be assessed for taxes in proportion to its true value (2, pp. 1 & 2). True value or cash value is usually interpreted to mean market value---or what the property would sell for in a transaction between a willing buyer and a willing seller. *Actual selling prices of comparable pieces of property are typically taken as the most reliable gage of market value.*

This presents a serious problem to farm land owners---because, as applied to farm properties in the rural-urban fringe area; this type of assessment results in valuations for tax purposes that are strongly influenced by sales of farm land for non-farm use. Farms that can support a market value of no more than a few hundred dollars an acre in agriculture may be valued at several thousand dollars an acre for taxation---if nearby lands have
sold for sub-division or industr
purposes for that amount. (11,
36 & 37)

Under the circumstances outl
ed the farmer has only two choic
sell his property or seek relief.

To sell is not always an ea
desirable or profitable soluti
Many people consider it unfair th
the farmer should be forced out
the early stages of the suburb
land boom and not be permitted
capture the full benefit of t
capital gains on the land he h
held all his life. *At the same time*
is argued that there should be a t
on the sales price of real est
when it is sold. Why not have t
seller give some of the increase
value to the sovereign, who in f
helped to increase his value
providing services and faciliti
(10, p. 75)

Professor Epp offers some coge
comments on this issue. ... *grea*
reliance should be placed on an
come tax to finance gene
governmental expenditures at
levels---local, state and nation
To be most appropriate, the inco
base for these taxes needs to
broadly defined. In conjuncti
with an income tax, more extensi
use should be made at state a
local levels of capital gains tax
This tax is especially appropria
in cases where society has creat
the capital gains, such as the i
crease in property values due to
ban expansion.

..., to obtain the land-use patter
that preserve open space a
provide variety in the landsca
greater use must be made of zoni
and public purchase. These mo
direct methods of control in co
junction with comprehensive co
munity planning provide mo
effective and long run control
land use than do preferential ta
ing systems. (4, pp. 85 & 86)

All states face a tax problem
the urban-rural fringe---*at least 1*
states have taken action and ma

**This number had increased to 27 by 1971.*

ovisions for a more equitable ethod of taxing farm property. Some of the various approaches clude:

(a) Preferential assessment law.
(b) Zoning and planning.
(c) Land use control.
(d) Tax-deferral system.
(e) Sale of rights to develop.
(f) Easement.
(g) Taking schools off the property tax. (11, p. 39)

Any measure designed to provide x relief for the farmer must be nsistent with the existing initutional structure. Local units of overnment are "creatures of the ate". They are dependent upon e state constitution, legislation d judicial decisions for their ganization, power, duties and ethods of operation- - -including e collection and spending of blic funds. Choices in financing cal public services are limited in e short run by this legal amework. Most of the major anges recommended by tax thorities are not permitted by the isting legal framework in Mississippi.

The most obvious means of oviding short run property tax lief is to improve property assessent and property tax administraon. *"The appraisal of property- - just as the verification of income x or sales tax returns- - -is a chnical job which requires rofessional skill and knowledge... A long and disgraceful record as proven that local property tax dministration except in rare cirumstances will fail. Sporadic ttempts at improvement by local itiative or under state stimulaon have at best been temporarily uccessful. If we want property tax ssessment to cease to be a political ootball then we must put it on a cientific basis. An increasing umber of people are coming reluctantly to the conclusion that this ill not be accomplished until the ppraisal of property is divorced rom local administration and made uniform by the same method by which intercounty utility property is appraised in most states- - -under uniform standards on a state-wide basis. Home rule will be more effectively guaranteed by leaving the decision on tax rates in fact as well as in name to locally elected responsible bodies."*(2, pp. 6 & 7)

The South Carolina Constitution is similar to that of Mississippi in that the assessor must follow value for assessment purposes. Late in 1968 the President of the South Carolina Association of Assessing Officials proposed property tax relief for farmers in the urban-rural fringe as follows: **Now what is the assessor's function with respect to legal requirements and how far can he go?**

(1) He must follow value for assessment purposes; however, what value? I submit, one sale does not make the market and speculative sales are not necessarily market value.
(2) The value he should use in my opinion is somewhere between true agricultural value and speculative value.
(3) What factors should he consider (there are others)?
    1. Past sales prices of acreage.
    2. Current sales prices of acreage.
    3. Past history of actual development growth.
    4. Zoning and restrictions. If any.

From these factors, he can project how long if will take for the urban area to reach and need the acreage tract for development. The assessor **must** *keep in mind that all the acreage cannot be developed at one time, and also, if all the acreage were put on the market at one time, then the value would be less. Based on his forecast for the future, he then can discount present values (actual market value) of acreage ready for development to the actual value that it has today, while the land waits until it is ready for development. In most cases, this value will be above agricultural value, and yet below speculative value.*

This approach may not be fair to the farmer; however, it would comply with the law and would be uniform and equitable with the values on all other properties. (10, pp. 73 & 74)

This suggested assessment procedure would require a high level of competence of the tax assessor. Care should be exercised to assure that it is applied only to bona fide farmers. There should be appropriate safeguards to prevent the speculator from enjoying reduced taxes while he waits for his land values to appreciate.

Short run solutions to the "property tax crisis" fall into the category of minor corrections or palliative measures and will not do the job. As stated earlier in this letter, a major question that must be answered is: How should the over-all tax structure of the state and local governments be adjusted to provide more equitable taxation (including real property taxation) in response to social and economic adjustment. This, of course, will require modification of the existing legal institutions pertinent to taxation.

The problem is, however, broader than the tax issue. Commenting on use-value assessment as one means of providing property tax relief to farmers, Professor Epp has said: *I do not intend to belittle the efforts being made to devise a program of property tax relief for farmers by addressing my suggestions to other related problems. I do hope, however, that people will realize the limitations in use-value assessment and will consider needed long range changes in the way we pay for governmentally provided services and in the way* **we control the patterns of land use.** (4, p. 86)

We in Mississippi would do well

to heed the words of Raleigh Barlowe when he says: ...*What do we want in Michigan? What do we want our southern counties to look like in another 10 or 20 years? Answers to these questions naturally involve value judgments. If we like the changing look of our countryside, or if our chief interest is in making money through real estate speculation, there obviously is little reason for concern. But if we are concerned about the blighting of prime agricultural areas by urban incursions, if we feel that our best agricultural lands should be preserved for future food production purposes, if we feel that open spaces and the rural landscape around our cities should be protected as part of our environmental heritage, or if we feel that a more orderly and efficient process should govern the development of rural lands for urban-oriented uses, then we have genuine cause for concern.*

I am very much concerned about what is happening. I feel that the time has come when the state of Michigan must act to protect its future. Many of our communities and counties already have planning commissions and zoning ordinances and we have state regulations that affect new subdivisions. The time has come, however, when we should start to plan on a statewide basis for how we want the state to look in the future, and then to act to bring about the necessary coordination of implementive efforts. (1, pp.17, 18, & 19)

Barlowe then adds: *Some of the principal weaknesses of the straight use-value assessment and the deferred taxing arrangements as land-use directional measures can be corrected by coupling them with other types of land-use measures. An eligibility rule that limits use-value assessments to classes of land-use directional measures can be corrected by coupling them with other types of land-use measures. An eligibility rule that limits use-value assessments to classes of land zoned for particular uses or a requirement that local planning agencies certify the eligible lands as primarily suited for the accepted uses has the beneficial effect of limiting the application of this taxing arrangement to the lands for which it was intended. Requirements that eligible owners secure given portions of their income from rural business pursuits or that they live on the land and not have incomes above some maximum level can keep these arrangements from becoming a boon to urban speculators. Some degree of permanence in the retention of the eligible lands in open-space uses can be achieved through the rigid administration of zoning ordinances, the establishment of statewide agricultural and conservation districts as in Hawaii, the creation of agricultural preserves as has been suggested in New York or through contracts with private owners involving development easements as has been tried in California.* (1, p. 22)

A recapitulation of the above may be presented in the form of questions as follows:

1. Should the use of the property tax be restricted primarily to property-related services and funding of services that are national or statewide in nature (education and welfare, for example) be shifted to state and national levels? If so, what changes in legal institution will be required to accomplish this?
2. Should the Homestead Exemption and other property exemptions be terminated and a credit against the state income tax be granted to groups of taxpayers deemed as deserving of tax relief?
3. Should the authority of local governments to impose a sales tax be terminated?
4. Are changes in the const tion and the statutes neede permit a more orderly an ficient development of r lands through the use of ta tion and land-use plannin combination?

Many fiscal experts around country would answer yes to e of the above questions, but wo do so with serious reservations to what changes are need *Research is needed to determ the economic effects of shift large proportions of public exp ditures to income and sales ta by removing them from the prop ty tax. Would the benefits capitalized into higher prices land and other affected proper Some say that land values wo skyrocket, that there would b tremendous capital gain, and l to a vast withholding of land fr use and a lot of other dire con quences. What would be the shif tax incidence? It is quite obvi that the sales and income ta would have to be collected by state and Federal Governme How would the legitimate lo state and Federal interests affected by the needed three-w sharing of revenue and resp sibility? How would the citizens assured that the tax levy on prop ty would really be reduced by amount of the costs of services t are shifted to other forms revenue? Would local special terest groups find other pu programs to absorb the init reduction in property taxes? Ma more questions could be asked. skill of the researcher is neede not so much to invent new sour of tax revenue, but rather to de mine the economic impact and cidence of proposed new syste and the administrative struct needed to assure efficiency in use of the tax dollar, equity amo income groups, and fulfillment the goals sought in the public s vice.* (5, p. 28)

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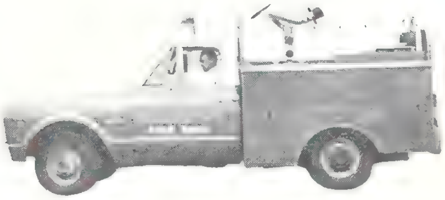
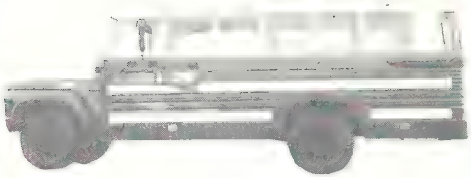
PROPERTY ASSESSMENT EQUALIZATION IN MISSISSIPPI: EFFECT ON COUNTY REVENUES, MILLAGE RATES, HOMESTEAD EXEMPTION AND THE COST OF REEVALUATION





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By Jerry W. Grace
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PROPERTY ASSESSMENT EQUALIZATION IN MISSISSIPPI: EFFECT ON COUNTY REVENUES, MILLAGE RATES, HOMESTEAD EXEMPTION AND THE COST OF REEVALUATION

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SUMMARY

Under present law, property is assessed and placed on the tax rolls in Mississippi according to its value. However, the rate at which property is assessed varies among the 82 counties, ranging from 9.3 percent to 30 percent. Equalization of assessments through the use of uniform practices in assessing property has been advocated in Mississippi for a number of years. This study deals with the effect of such an assessment equalization on county revenue and homestead exemption reimbursement, and also estimates the cost of the associated property reevaluation.

A uniform assessment rate of 30 percent was selected for this study. Calculations were made to estimate the effect of uniform assessment on revenue, millage rate adjustments, and homestead exemption reimbursement in each county.

Uniform assessment at 30 percent would result in the collection of more than 59 million additional tax dollars by all of Mississippi's counties. This represents an increase of more than 72 percent over 1970. Millage rates that would result in each county collecting the same amount of revenue as in 1970 also were determined.

Expenditures from the State's general fund to reimburse counties for homestead exemption amounted to over $19 million in the 1968-70 biennium and would be expected to increase by over $12 million under uniform assessment with no change in millage rates.

Results of the study indicate that adoption of a uniform assessment rate will significantly affect the revenue collecting process. It will create a higher total assessment which, in turn, will call for adjustments in millage rates and greater amounts of state funds for homestead exemption reimbursement.

Adoption of a uniform assessment rate would likely require the reevaluation of all property State. The cost of such a ree tion by county and for the was estimated from a relati established using data Alabama (which is presen dergoing reevaluation). T timated cost was $22.3 milli

Other factors not conside this study will bear care amination, especially the in which the incidence of shifted among individuals.

Mississippi has many ne tax revenue and it must us tax revenue source efficientl study examines one of the enue sources and a propos could have significant effec The Mississippi Legislatu eventually decide this matt it must have objectively rese information to properly ma decision. It was the purpose study to help provide such in tion.

INTRODUCTION*

here is no better way to begin a y of the property tax than to e Ronald Welch's remarks ut the subject: *"If California is cal of the nation, the property is the most unpopular of all ma- taxes now employed in the ted States. It is under attack n all sides. It is denounced by fare economists as our most ressive major tax, by nessmen as our most inflexible by farmers as our most unfair by the aged as our tax least ted to ability to pay, by guar- s of the law as our most ineptly ninistered tax, and by conscious nstinctive disciples of Henry rge as our most repressive tax"* [1]

lthough one might wonder why property tax has not long been abandoned, examination of budgeting restrictions on governments and the demands made for public funds makes it apparent that government must use every tax base available if it is to satisfy the wants of its people. During the past decade the level and scope of government expenditures have skyrocketed. Expenditures of local and state governments have grown faster over the last 10 years than have either gross national product or personal income. In fact, for the period 1960-1971, these expenditures rose by 200 percent, while gross national product grew by only 108 percent and personal income by 114 percent [21].

The tax on real property plays no role in financing government on a national level, and its importance as a revenue source at the state level is negligible in most states. However, at the local level the property tax is the most widely used form of taxation. The impact of local governments on the individual citizen is perhaps greater than that of state or federal government, since the responsibilities of local governments include providing such things as fire and police protection, recreational and educational facilities, water and sewerage systems, roads, and in many instances, electricity. Vast sums of money are needed to fund these public services. As long as no large source of revenue other than the property tax is available, local governments will probably continue to use the property tax.

The Problem

nder present Mississippi law perty is assessed and placed on tax rolls in proportion to its ue. The law specifies neither the portion of value nor a uniform em of property evaluation to be d in assessments. Rather, these ters are left to the discretion of l taxing authorities. Assess- nt proportions currently used in 82 counties vary from 9.3 per- t in Tishomingo to 30 percent in ms and Warren (Appendix le 1).

he question of assessment can- be isolated from the complex tem of property taxation of ich it is a part. Mississippi vides tax relief to homeowners through a homestead exemption law that provides for the exemption of up to $5,000 of the assessed value from certain taxes. In some counties, where the assessment of an individual homeowner is less than $5,000, a taxpayer can be exempt from as much as two thirds of his total bill.[2] The state reimburses the counties, subject to certain restrictions, for the revenue foregone due to the exemption.

Many people in Mississippi feel that the variance of assessment ratios is inequitable and have called for an equalization of assessment ratios. Such an assessment equalization in Mississippi would affect county revenue and homestead exemption reimbursement. This study was undertaken to estimate the magnitude of those effects.

The specific objectives of this study were:

1. To discover the present status of assessment practices and homestead exemption in Mississippi.
2. To estimate the impact of a uniform assessment rate on county revenue and homestead exemption reimbursement, and
3. To estimate the cost of total reevaluation of real property in the state.

The material in this report is taken from an unpublished Masters thesis ("Impact of Assessment Equalization County Revenue and Homestead Exemption in Mississippi", Mississippi State University, August 1974) tten by Mr. Grace and directed by Dr. Tyner.

Numbers in brackets indicate references cited in the bibliography.

This study was undertaken before Senate Bill No. 2566 of the 1974 Session of the Mississippi Legislature (which homeowners 65 or older, or permanently disabled, exempts the first $5,000 of homestead valuation from all perty tax) became law. The impact of that law upon revenue-raising capabilities of the property tax in the state hus not considered in this report.

Procedure

The first step was to examine the assessment system and the process of homestead exemption reimbursement to discover how each actually works. Next, data were gathered from secondary sources. Finally, a simple mathematical model of the property tax system was constructed and the effect of a uniform assessment rate was estimated.

Data on the costs of reevaluation were available from a then current reevaluation being performed in Alabama. Variables were selected for a "cost of reevaluation" equation and a regression analysi performed, using the Ala data. The prediction equ derived was then applied to si data for the State of Mississi estimate the cost of reevalua

Sources of Data

The State Tax Commission of Mississippi is responsible for revenue collections at the state level and has regulatory power over the collection of revenue by local governments. The Commission, which is responsible for administering homestead exemption as well as for tax collection, publishes a biennial report of its activities. The 1970 report, the latest published at the time of this study, was the major source of information. Information on total assessment, exempt assessments, reimbursements, and number of applicants for homestead exemption (classified by assessment in increments of $1,000) was taken from that report.

Also provided by the Commission were the 1972 millage rates levied in each of the counties. Although taxes are collected county-wide, special levies may be placed on property owners who live in special districts—for roads, schools, drainage and other special services. For this study, one millage figure was needed for each county and was calculated by using average levies. In calculating the average, special district levies were omitted if their inclusion would have caused the average to be disproportionately high. Because of the size of levies imposed in drainage districts and because of the failure of these districts to follow regular political boundaries, such levies were also omitted from the average.

The figures used as current assessment rates were furnished by the State Tax Commission. These figures were considered the best available although they are subject to several weaknesses. First, they are based on a 1962 study [3], and do not adequately reflect the changes that hav cured since then. Second, original study considered property recently transferre determining the assessment r leaving unknown the rat assessment of property that been on the rolls for many without being transferred. T the rates that had been updat the Commission were up through a subjective procedu

Data regarding cost of praisal came from the Ala Department of Revenue. Alabama was currently und ing statewide reappraisal, it possible to secure accurate, date information on costs o praisal by professional firm the time of this study 1 Alabama's 67 counties had t and accepted bids for such ser

Review of Previous Studies

The question of property assessment practices and their relation to homestead exemption in Mississippi has been addressed by the Mississippi Economic Council for a number of years. The MEC has proposed changes in assessment practices and has published several articles on the subject.

Perhaps the most important of these is the report from the sales-assessment ratio study performed by the Bureau of Business and Economic Research at the University of Mississippi in 1962 [13]. This study is the most recent one of its kind, providing information regarding assessment rates in each of the 82 counties.

In 1967, the MEC published an article entitled *Impact of Assessment Equalization on Homestead Exemptions* [46]. That article presented the situations that had occurred in several counties involving changes in homestead exemption reimbursement after a reevaluation and reassessment.

In 1971, MEC released a publication entitled *County Assessment Practices* [14]. That report presented the results of a questionnaire sent to assessors in five "representative" counties chosen by the State Tax Commission ing typical of the state. The re of this study indicated that in t counties questioned, there wa enough manpower available t amine every parcel of propert the tax roll each year.

Dr. Robert N. Howell, Prof of Economics at Mississippi University, has written tw ticles discussing the equity as of homestead exemption an ability of homestead exempti achieve its goal of encoura home ownership [9, 10]. Bo these articles were written at t quest of the MEC.

ll of the above mentioned ature in some way relates to the sissippi Economic Council. To h best of the authors' knowledge, h MEC is the only organizaiton t has published material about assessment equalization in Mississippi.

In December of 1973, the Mississippi Farm Bureau Federation adopted a plan to classify land for taxing purposes according to use. At the time of this writing, two other politically influential groups, the East Mississippi Council and the Delta Council, have not taken a position on property tax but have the matter under consideration.

ASSESSMENT PRACTICES AND HOMESTEAD EXEMPTION REIMBURSEMENT: THE CURRENT SITUATION

etermination of the current us of property assessment and nestead exemption in Mississippi was important to this study. This section examines the legal aspects, the revenue respects and property tax administration in other states and in Mississippi.

Property Assessment

bviously, administration of the perty tax must conform to the . The major legal guideline is d in Section 112 of the Mississippi Constitution which says: *xation shall be uniform and al throughout the state. Proper- hall be taxed in proportion to its ue. Property shall be assessed axes under general laws and by form rules in proportion to its ue."* [13]

alue Determination—The rmination of the value of a cel of property is the duty of an ted county assessor, who is ponsible for seeing that all perty is found, assessed, and ced on the tax rolls. Legal lance as to the determination of ue is provided by the Mississip- Code. Section 9759 of the Code the term "cash value" and nes it as "not what it might sell at a forced sale, but what he uld be willing and expect to cept for it if he were disposed to it." In another part of the Code, tion 9769, the term "true value" sed with a similar definition to t used in Section 9759 [3, 4].

luch property in Mississippi ch as utilities) is not now, and y never be, for sale. The State, vever, assumes the responsibili- for evaluating the property of ities, which does provide for a ree of uniformity among coun- in this aspect of the property system

ocumentary stamps are no ger required in the sale of perty, leaving the sale price a tter between only buyer and seller. As long as these stamps were used, assessors had a good guide to market value.

Assessment Procedure—The proportion of value at which property is to be assessed is not defined by state law, nor is it a policy decision of the State Tax Commission. The Board of Supervisors of each county decides what rate to use.

Once the tax roll is prepared, it is presented to the county Board of Supervisors, which is responsible for the accuracy and fairness of the roll. After the Board's review, the rolls are open to examination by the public. Property owners have the right to file objections to their assessments and the Board of Supervisors has the authority to adjust assessments.

Following any adjustments the Board may make, the tax roll is sent to the State Tax Commission. The Commission is responsible for seeing that the assessments are in order and has the authority to direct the County Board of Supervisors to make changes on the assessment rolls. Should changes be ordered, the Board must make public notice so that those affected may make objections. If a Board should deem it necessary, it may call for a hearing before the State Tax Commission, at which time not more than five witnesses may present objections to the changes ordered by the Commission. The decision then made is final and the Board of Supervisors must follow the Commission's directions. Taxpayers have recourse in the courts.

In determining the amount of tax that will be derived from a piece of property, a millage rate is used. The millage rate is simply a percentage of the value of the property assessment that will be paid as tax. This rate is determined by the County Board of Supervisors subject to maximums allowed by the Law.

In arriving at the millage rate, the Board begins with the budgeting needs for the coming year. Expected revenue from sources outside the county, such as state and federal aid, can be "taken off the top". Once this has been done, the amount of revenue still needed will determine the millage rate. Since the total taxable assessment is known, the rate is determined by dividing the amount needed by the total assessment.

Thus, there are two factors that can be varied to change the amount of property tax—the assessment rate and the millage rate. At the outset of this study it was hypothesized that counties with low assessments would have high millage rates and vice versa, with the assumption that counties will demand revenue proportionate to their size and population. A correlation analysis was performed to determine if a relationship exists between the assessment rate and the millage rate. The calculated correlation coefficient (r) had a value of -.31. The negative coefficient indicates the expected inverse relationship between millage rate and assessment rate, but the numerical value suggests that the two are not closely related.[3]

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he range of r is from -1 to +1. A value near zero suggests a "weak" relation.

Assessment practices in Mississippi are subject to several institutional restrictions. The fact that all those responsible for the administration of property tax at the local level are subject to election makes changes in the system a sensitive issue.

Property is taxed in each of the 50 states. The different bases of assessment are presente Appendix Table 2 to provide comparison with Mississ assessment policy.

Homestead Exemption Reimbursement

A cursory examination might suggest that homestead exemption and property assessment rates are entirely different problems. However, variations in assessment rates can have a profound effect on the reimbursement aspects of homestead exemption if they occur without accompanying legal adjustments.

The best place to begin consideration of this area is with the Law itself. In the years during and following the depression of the early 1930's the loss of home ownership for nonpayment of taxes was common. To alleviate this problem, the legislature in 1934 passed a homestead exemption law. This allowed for the exemption of levies on a maximum of $1,000 of the assessed evaluation of the homestead and forty acres of the land adjoining. The exemption was increased to $2,500 in 1935 and to $5,000 in 1938. The land area exempt was increased to 160 acres in 1935 and has not been changed since.

The law in effect today is the Homestead Exemption Act of 1946 with practically the same provisions as the 1938 version. Under this law as much as 43 mills of the total levy can be exempt.[4] In Green County (the only county in the state with a 43 mill exemption) a homeowner with an assessment of $5,000 would realize a savings of $215 on his tax bill. This represents revenue that could have been collected and used by the county in the absence of homestead exemption. The State, however, reimburses the county for the revenue loss.

The amount of reimbursement is subject to a 1952 law which limits the amount of exempt assessment in a county to the ratio of exempt to nonexempt that existed in 1950. The Law, referred to as House Bill 43, states: *"Beginning with the 1952 supplemental roll, and for each succeeding roll thereafter, the percentage that the total exempt assessed value bears to the assessed value of all realty for each county and municipal separate school district shall not exceed the percentage that the total exempt assessed value shown by the corrected 1950 supplemented roll bore to the total assessed value of all realty shown by the corrected 1950 land roll for each county and municipal separate district"* [2].

The Law specifies how many mills may be exempt for different tax levies. They are:

The relationship bet
homestead exemption reimb
ment and assessment ra
simple—if assessment rates a
creased, reimbursement will
creased, and vice versa. Thi
been shown in several cou
that have undergone reevalu
and reassessment.

In 1962, Adams County h
assessed valuation on real pro
of $16,030,843. During the f
ing two years, the county
derwent a reevaluation
reassessment. The assessed v
tion increased to $32,403,410 (
percent greater than 1962.) Ex
valuation increased by 126.7
cent with reimbursement
creasing from $166,945 to $37
The same has been true in Jac
DeSoto, and Warren Cou
where reimbursement followi
reassessment increased 92.8
cent, 64.7 percent, and 49.8 pe
respectively [16].

State Advalorem Tax	*4 m*
General County Maintenance	
In counties having an assessed valuation of less than $3 million	*12 m*
In counties having an assessed valuation of $3 million and less than $5 million	*10 m*
In counties having an assessed valuation of $5 million and less than $8 million	*9 m*
In counties having an assessed valuation of $8 million and less than $10 million	*8 m*
In counties having an assessed valuation of $10 million and less than $20 million	*7 m*
In counties having an assessed valuation of over $20 million	*6 m*
Road and Bridge Maintenance	*7 m*
School Maintenance	*20 m*
Junior College or Agricultural High School	*3 m*

---

[4] *Theoretically, as much as 46 mills could be exempt but the provisions in the law tie the exempt mills for r and bridge maintenance to the total assessment in the county. No county has a total assessment small enoug qualify for the additional exempt mills, making 43 the maximum.*

imbursement of revenue lost ugh homestead exemption has costly to the State. With the in- ese in population and in home ership, and with the consistent ease in property values, the has risen from less than two ion dollars in 1938 to almost million in 1970 (Appendix le 3). If this trend continues, bursements are estimated to ed $26 million by 1980 (See pendix Table 3).

Homestead exemption is not the only type of property tax relief in use in the United States. Systems based on income rather than amount of assessment have gained in popularity over the years and are widely used. In some states tax relief is available only to people with various types of hardships. Several states have systems similar to the one in Mississippi. A very abbreviated presentation of the different systems of property tax relief used by the states is given in Appendix Table 5.

It is clear that all of the factors involved in property taxation are interrelated and changes in any aspect of the taxing system will alter a county's ability to raise revenue. With the knowledge of these relationships, it is possible to analyze any change in the property taxation system and estimate the effects it would have.

ESTIMATION OF IMPACT OF ASSESSMENT EQUALIZATION

he first question to be resolved is study was the choice of an ssment rate. Since the major ctive was to achieve uniformi- he rate selected for use in this ysis was relatively unimpor- . However, there was no reason e arbitrary since some prece- existed for use of a particular (1) the highest rate currently se is 30 percent; (2) the Mis- ppi Economic Council has osed the use of a 30 percent [14]; and (3) the State Tax mission assesses public ser- corporation property and mobiles at 30 percent of value. s, 30 percent was chosen as the orm assessment rate for this y.

The first step in estimating the impact of uniform assessment was to establish a base for comparison using the latest property assessments and rates. Total real property values for each county were calculated using 1970 property assessments (the latest available) and the corresponding assessment rates.[5] An example will serve to illustrate this procedure: Alcorn County had a property assessment of $9,787,000 in 1970 based on a 12.5 percent assessment rate. The total value of the assessed property would then be $9,787,000 ÷ .125 = $78,296,000.

Once the total property values were calculated for each county, these values were reassessed at the uniform rate of 30 percent. The reassessed value for Alcorn County, for example, was .30 × $78,296,000 = $23,488,800 (an increase in assessed value of 140 percent).

For all counties in the State, increases in assessment would range from no change in Adams and Warren Counties (which already assess at 30 percent) to 223 percent in Tishomingo County (with a current assessment rate of 9.3 percent). Based on the calculations for a uniform assessment at 30 percent for all counties, the State's total assessment would increase by 68.84 percent (from $1,309,502,000 to $2,210,909,700). Appendix Table 4 shows the comparative assessments by county and for the State.

Effects on Revenue

creasing assessment without esponding changes in millage s would increase tax revenue endously, with some counties pling or tripling the revenue cted under the present system. g Alcorn County again as an nple, it was estimated that tax nue from real property would ease from $707,110 to $1,697,- These values were calculated applying the current millage s, which appear in Appendix le 6, to the assessments before after the reassessment. Over the entire state, an additional $59,545,710 of revenue could be collected, representing an increase of 72.25 percent. Table 7 of the Appendix presents estimated revenue increases for each county.

Considering the sensitivity of lawmakers and law enforcers to public opinion, it is likely that a reassessment would be accompanied by a shift in millage rates. In November of 1973, two years after the first set of proposals calling for equalized assessments was made, the Mississippi Economic Council added to their plan a recommendation requiring a limit on any increased revenue from one tax year to another caused by equalizing assessments. This could be done, as they explained, by adjusting the millage rate.

Estimates of required changes in millage rates were made in this study assuming that the same level of revenue is desired both before and after reassessment. Alcorn County has an estimated present revenue from real property of

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pendix Table 1 shows these assessment rates by counties.

$707,110 based on a tax levy of 72.25 mills applied to an assessment of $9,787,000. If the assessment were increased to $23,488,800 a millage rate of only 30.10 mills would be required to collect the same revenue. (This figure was arrived at by dividing the revenue desired by the 30 percent assessment.) A presentation of such changes in millage rates, assu a constant level of rev appears in Appendix Table 8.

Effects on Homestead Exemption

The estimation of changes in reimbursement could not be approached in the same manner as changes in revenue. Because the homestead exemption law allows no more than $5,000 of assessment per parcel of property to be exempt, the exempt assessed value will not increase in exactly the same proportion as nonexempt assessed value. Property that is currently totally exempt may be subject to some tax after reassessment.

To illustrate the estimation procedure, Alcorn County will again be used. In 1970, Alcorn County had the following composition of exempt property in numbers of parcels classed by assessed valuation:

Class	Valuation Range	No. of Parcels
I	1-1000	3682
II	1001-2000	1513
III	2001-3000	402
IV	3001-4000	97
V	4001-5000	21
VI	over 5000	14

Information was not available as to the total value of property in each of the six classes. Since this information was necessary in order to estimate the effect of reassessment on reimbursement, an approximation procedure was used. First, a uniform distribution of the value of parcels within each class was assumed. The average value of parcels within each class I-V would then be $500, $1,500, $2,500, $3,500, and $4,500, respectively. All property in class VI of course, has a value of $5,000 or greater since $5,000 is the maximum exemption.

Since the total amount of present exempt assessment was known, it was possible to test the above assumption of a uniform distribution. In the case of Alcorn County, there was an exempt assessment in 1970 of $5,551,000. Applying the average values under the uniform distribution assumption, an amount of $5,617,500 was calculated, indicating that the estimate was in error by only 1.2 percent. Since in no county did the calculations result in an error greater than six percent, it was felt that, for the purposes of this study, the assumption of a uniform distribution of parcels within each valuation class was acceptab

In order to estimate reimb ment expense after an equaliz of assessments, it was necess know what movements of pro parcels among the valu classes would occur. Followin equalization, Alcorn County w experience an increase in as ment of 140 percent causin boundaries of the classes (v tion ranges) to change as foll

Class	Valuation Range	No. Parc
I*	1-2400	368
II*	2401-4800	151
III*	4801-7200	40
IV*	7201-9600	9
V*	9601-12000	2
VI*	12001 & greater	1

To estimate reimbursement parcels must be reassigne classes having the original daries. Using the uniform dis tion, parcels were reassigned Table 1.

Assigning the average value have been assumed for each the total exempt assessment

Table 1. Estimates of movements of property parcels among classes as a result of assessment equalization, Alcorn County.

To Class	I	II	III	IV	V	VI	Total
From Class I*	1534	1534	614				3682
From Class II*			378	631	504		1513
From Class III*					52	350	402
From Class IV*						97	97
From Class V*						21	21
From Class VI*						14	14
Total	1534	1534	992	631	556	482	5729

estimated. The reimbursement can then be estimated by applying the exempt millage rate to these figures. Alcorn County has an exemption of 40 mills, of which 4 mills is the State levy. Applying the net county exempt rate of 36 mills to the total exempt assessment of $2,668,500[6] gives an estimated reimbursement of $456,066. The amount of State tax exempt would be .004 × $12,668,500 = $50,674. If one considers tax never collected as tax lost, then the total cost to the State of homestead exemption in Alcorn County, disregarding administrative expenses, would be $506,740.

Based on 1970 figures, the estimates indicate that the State could expect an increase in exempt assessment of 58.7 percent. Reimbursement would increase by 68.4 percent (from $19,590,844 to $32,991,248). State tax foregone would increase by 58.2 percent (from $2,417,716 to $3,824,273). The total "cost" of homestead exemption to the State (disregarding administrative expense) following a reassessment for equalization under the conditions specified in this study is estimated to increase from $22,008,560 to $36,815,521 (by 67.3 percent). Appendix Table 9 shows actual reimbursement in 1970 and predicted expense to the state under reassessment.

Other Issues

This study has dealt with forces that have seemed to be counterbalancing; as assessments increase, millage rates decrease to keep the total amount of tax revenue and, presumably, the tax burden of the individual taxpayer the same. The latter is not entirely true, however, for those taxpayers whose property would be increased from a value that was totally exempt to one that is only partially exempt.

Through reimbursement the State is paying in some cases as much as two-thirds of the total tax bill of an individual on the first $5,000 of assessment. The individual must pay all of the tax bill on all property valued at over $5,000. A tax equalization will place many parcels beyond the $5,000 mark. Even after a reduction in the millage rate the taxpayer whose property had been moved into partially exempt status would be paying a higher percentage of his tax bill himself after equalization than before.

ESTIMATING THE COSTS OF REEVALUATION

If a uniform assessment policy were to be adopted, it is likely that a total reevalution of all property in the state would be required. The most commonly used method of property reevaluation is through the use of a professional firm usually selected on a "lowest bid" basis. A number of counties and municipalities in Mississippi have undergone such a reevaluation at their own initiative.[7]

The analysis of the cost of reevaluation is based on Alabama's recent experience in a statewide reevaluation. Data on the number of parcels of property in 19 Alabama counties, bids by professional appraisal firms on a county basis, and the bids selected were obtained from the Alabama State Tax Commission. These cross-sectional data were assumed to be sufficiently representative of Mississippi conditions to allow their use for estimating the cost of a similar reevaluation process in Mississippi.

The technique of analysis used was regression analysis, which attempts to "explain" the level of one variable (termed the "dependent" variable) on the basis of the levels of one or more explanatory (independent) variables. The "cost of reevaluation per county" was the

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For Alcorn County the total exempt assessment is calculated as:

No. of Parcels		Average value		Estimated value
1534	×	500	=	767,000
1534	×	1500	=	2,301,000
992	×	2500	=	2,480,000
631	×	3500	=	2,208,500
556	×	4500	=	2,502,000
482	×	5000	=	2,410,000
		Total	=	12,668,500

[7] *The following counties have undergone reevaluation on their own initiative in recent years: DeSoto, 1961; Warren, 1961; Adams, 1964; Jackson, 1964; Leflore, 1968; Holmes, 1972; Lafayette, 1973. Lincoln and Sunflower are currently undergoing reevaluation.*

information desired, so this variable was selected as the dependent variable. Examination of possible explanatory variables indicated the variable "number of parcels of property within a county" provided the best explanation of cost of reevaluation per county.

The regression analysis using the Alabama data resulted in the following estimating equation:

$$\hat{Y} = 69.555 + .013X$$
$$(.000898)$$

where Y = cost of reevaluation for each county (in $1,000)

and X = number of property parcels in each county.

The percent of variation in Y explained by X was high, as indicated by $R^2 = .93$. The standard error of the regression coefficient (in parentheses above) resulted in a t-value of 14.477 which indicates, statistically, a high probability that a real relationship exists between the number of parcels and the cost of reevaluation.

These statistical results provide a basis for using this equation to estimate the cost of reevaluation for Mississippi counties. The number of parcels in each Mississippi county was used as an observation on X, and provided an estimated value ($\hat{Y}$) of the cost in each of the 82 counties. Appendix Table 11 provides a list of Mississippi counties, number of parcels of property in each, the estimated cost of reevaluation per county, and the estimated average cost of reevaluation per parcel in each county.

The estimated average cost per parcel ranged from $14.08 in Hinds County to $94.64 in Issaquena County,[8] with an average of $18.04 for the State. The total estimated cost of reevaluation for the State was slightly in excess of $22.3 million.

Whether such an expenditure would be justified is beyond e scope of this study, which o y points out some factors that sho d be weighed in arriving at a reevaluation decision. One of the is the total amount of revenue t could be obtained with a uniform 0 percent assessment, and it l already been made clear that propriate adjustments in cou y millage rates would result in no ditional revenue—there would o y be a shift in the incidence (v pays) of the tax. A second facto s the homestead exemption re bursement. Reevaluation and adoption of a uniform 30 perc assessment rate would result more property (in dollar value) ing exempt, as indicated by the timated reimbursement figure $12,117,098. If the State u general funds to make this re bursement, the incidence of would be further shifted fr property to other sources.

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[8] *If Issaquena County is excluded, the range in average cost per parcel is only $14.08 to $33.32 (Sharkey Coun). Issaquena County contained only 856 parcels of property—the next smallest number of parcels in a county s 3,940.*

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Appendix Table 1. Property tax assessment rates by county, Mississippi, 1973.

County	Percent of value	County	Percent of value
	(percent)		*(percent)*
Adams	30.0	Leflore	25.0
Alcorn	12.5	Lincoln	13.0
Amite	14.0	Lowdnes	14.0
Attala	20.0	Madison	13.0
Benton	14.0	Marion	20.0
Bolivar	20.0	Marshall	18.0
Calhoun	11.0	Monroe	11.6
Carroll	22.0	Montgomery	20.0
Chickasaw	15.0	Neshoba	13.0
Choctaw	20.0	Newton	20.0
Claiborne	22.5	Noxubee	23.0
Clarke	13.0	Oktibbeha	19.0
Clay	17.3	Panola	14.5
Coahoma	20.0	Pearl River	22.0
Copiah	18.0	Perry	19.0
Covington	12.1	Pike	25.0
DeSoto	20.0	Pontotoc	14.0
Forrest	13.0	Prentiss	13.0
Franklin	18.0	Quitman	20.0
George	10.0	Rankin	13.0
Greene	19.0	Scott	14.0
Grenada	13.1	Sharkey	19.0
Hancock	21.0	Simpson	14.0
Harrison	10.0	Smith	17.0
Hinds	20.0	Stone	14.0
Holmes	23.0	Sunflower	18.0
Humphreys	20.0	Tallahatchie	15.8
Issaqueana	19.0	Tate	16.5
Itawamba	12.0	Tippah	14.0
Jackson	24.0	Tishomingo	9.3
Jasper	10.0	Tunica	15.0
Jefferson	18.5	Union	15.5
Jeff Davis	15.0	Walthall	18.0
Jones	17.0	Warren	30.0
Kemper	14.0	Washington	20.0
Lafayette	15.0	Wayne	15.0
Lamar	10.0	Webster	21.0
Lauderdale	25.3	Wilkinson	14.0
Lawrence	25.0	Winston	15.0
Leake	19.0	Yalobusha	17.0
Lee	15.0	Yazoo	22.0

SOURCE: Mississippi State Tax Commission.

STATE	BASIS
Alabama	3 Classes I. Utilities — 30% II. Unclassified property — 25% III. Agricultural, forest, residential — 15%
Alaska	Full and true value
Arizona	5 Classes I. Airlines; railroads; private car companies; mines and standing timber — 60% II. Telephone and telegraph companies; gas, water, and pipelines — 40% III. Commercial and rental properties — 25% IV. Agricultural property — 18% V. Residential property — 18%
Arkansas	20% of true value in money
California	25% of true value
Colorado	30% of value
Connecticut	Uniform percentage of actual valuation
Delaware	True value in money
Florida	Full cash value
Georgia	40% of fair market value
Hawaii	Percentage of fair market value
Idaho	20% of value
Illinois	Fair cash value [1]
Indiana	33 1/3% of true cash value
Iowa	27% of actual value
Kansas	30% of fair market value
Kentucky	Fair cash value
Louisiana	Actual cash value
Maine	Just value
Maryland	Full cash value less an allowance for inflation should it exist
Massachusetts	100% of fair cash value
Michigan	50% of true cash value
Minnesota	[2]
Mississippi	Proportion of actual value
Missouri	33 1/3% of true value in money
Montana	Montana uses a system of 10 classes with a percentage of market value
Nebraska	35% of actual value
Nevada	35% of full cash value
New Hampshire	Full and true value in money
New Jersey	Not lower than 20% or higher than 100% of true value
New Mexico	Not to exceed 33 1/3% of value
New York	Portion of actual value
North Carolina	True value in money
Ohio	[2]
Oklahoma	Not to exceed 35% of fair cash value
Oregon	100% of its true cash value
Pennsylvania	Actual value
Rhode Island	Uniform percentage of fair cash value not exceeding 100%
South Carolina	True value in money
South Dakota	60% of full value
Tennessee	3 Classes I. Public utilities — 55% II. Commercial and industrial — 40% III. Farm and residential — 25%
Texas	Full and true value in money
Utah	30% of reasonable fair cash value
Vermont	50% of appraised value
Virginia	Fair market value
Washington	100% of true and fair value
West Virgina	True and actual value
Wisconsin	True cash value
Wyoming	Fair value

SOURCE: Commerce Clearing House, *STATE TAX GUIDE*, All States edition, March 1974.

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[1] In practice, Illinois counties are found to assess property as low as 20% of value.

[2] Minnesota and Ohio have complex systems of classification unsuitable for presentation in a table of this nature.

Appendix Table 3. Homestead exemption reimbursements by biennium, Mississippi, 1938-1970, with projections to 1980.

Year	Reimbursement
1938	$ 2,881,449.70
1940	3,401,239.96
1942	3,711,044.49
1944	3,931,749.43
1946	4,868,367.97
1948	6,067,325.62
1950	6,788,446.28
1952	8,047,067.87
1954	8,712,118.57
1956	9,588,857.44
1958	10,419,616.46
1960	11,642,843.65
1962	12,541,269.12
1964	14,291,134.69
1966	15,448,134.95
1968	17,148,188.26
1970	19,590,844.13
Estimated reimbursement	
1972	20,332,000.00
1974	21,898,000.00
1976	23,474,000.00
1978	25,046,000.00
1980	26,598,000.00

SOURCE: Data for 1938-1970 from "Report of the Ad Valorem and Homestead Exemption Divisions," Mississippi State Tax Commission, 1970.

1972-1980 projections derived from the equation:

$\widehat{\log_{10} R} = 3.38001 + .06989T - .00102T^2$

R = reimbursement in millions of dollars

T = time (T = 1 in 1952, 2 in 1954, etc.)

Appendix Table 4. Comparison of 1970 assessments and assessments based on a uniform rate of 30%, by county, Mississippi.

County	1970 assessment	Calculated at 30%	Increase
	(dollars)	*(dollars)*	*(percent)*
Adams	39,209,000	39,209,000	0
Alcorn	9,787,000	23,488,800	140
Amite	5,955,000	12,760,700	114
Attala	8,779,000	13,168,500	50
Benton	3,189,000	6,833,600	114
Bolivar	34,139,000	51,208,500	50
Calhoun	5,006,000	13,652,700	173
Carroll	5,306,000	7,235,500	36
Chickasaw	6,400,000	12,800,000	100
Choctaw	4,132,000	6,198,000	50
Claiborne	6,254,000	8,338,700	33
Clarke	7,771,000	17,933,100	130
Clay	7,572,000	13,130,600	73
Coahoma	31,707,000	47,560,500	50
Copiah	11,797,000	19,661,700	66
Covington	4,370,000	10,834,700	147
DeSoto	23,167,000	34,750,500	50
Forrest	29,197,000	67,377,700	130
Franklin	3,649,000	6,081,700	66
George	6,412,000	19,236,000	200
Greene	4,838,000	7,638,900	57
Grenada	8,034,000	18,398,500	129
Hancock	11,784,000	16,834,300	42
Harrison	52,336,000	157,008,000	200
Hinds	200,064,000	300,096,000	50
Holmes	14,949,000	19,498,700	30
Humphreys	11,332,000	16,998,000	50
Issaquena	4,097,000	6,472,100	57
Itawamba	5,001,000	12,502,500	150
Jackson	62,613,000	78,266,200	25
Jasper	4,716,000	14,148,000	200
Jefferson	4,382,000	7,105,900	62
Jefferson Davis	3,833,000	7,666,000	100
Jones	29,178,000	54,708,700	87
Kemper	6,171,000	13,223,600	114
Lafayette	8,141,000	16,282,000	100
Lamar	5,253,000	15,759,000	200
Lauderdale	60,147,000	71,320,600	18
Lawrence	6,138,000	7,365,600	20
Leake	7,707,000	12,168,900	57
Lee	25,804,000	51,608,000	100
Leflore	40,859,000	49,030,800	20
Lincoln	10,745,000	24,796,200	130
Lowndes	26,234,000	56,215,700	114
Madison	15,166,000	34,998,800	130
Marion	13,799,000	20,698,500	50
Marshall	9,742,000	16,236,700	66
Monroe	12,731,000	32,925,000	158
Montgomery	6,225,000	9,337,500	50
Neshoba	6,425,000	14,826,900	130
Newton	9,777,000	14,665,500	50
Noxubee	7,736,000	10,090,400	30
Oktibbeha	14,414,000	22,758,900	57
Panola	11,360,000	23,503,400	107
Pearl River	13,633,000	18,590,500	36
Perry	4,001,000	6,317,400	57
Pike	24,041,000	28,849,200	20
Pontotoc	6,159,000	13,197,900	114
Prentiss	6,635,000	15,311,500	130
Quitman	11,192,000	16,788,000	50
Rankin	19,158,000	44,210,800	130
Scott	7,898,000	16,924,300	114
Sharkey	6,862,000	10,834,700	57
Simpson	7,310,000	15,664,300	114
Smith	4,956,000	8,745,900	76
Stone	3,995,000	8,560,700	114
Sunflower	24,191,000	40,318,300	66
Tallahatchie	8,454,000	16,051,900	89
Tate	8,890,000	16,163,600	82
Tippah	5,354,000	11,472,900	114
Tishomingo	4,418,000	14,251,600	222
Tunica	8,092,000	16,184,000	100
Union	8,046,000	15,572,900	93
Walthall	5,282,000	8,803,300	66
Warren	49,922,000	49,922,000	0
Washington	43,200,000	64,800,000	50
Wayne	6,223,000	12,446,000	100
Webster	6,023,000	8,604,300	82
Wilkinson	4,733,000	10,142,100	114
Winston	9,018,000	18,036,000	100
Yalobusha	4,211,000	7,431,200	76
Yazoo	22,074,000	30,100,900	36
State	1,309,502,000	2,210,909,700	68

SOURCE: 1970 Assessment data from "Report of the Ad Valorem and Homestead Exemption Divisions," 1970, Mississippi State Tax Commission. Calculated value derived from the formula:

Appendix Table 5. **Summary of property tax relief by states, United States, 1974.**

State	General property tax relief	Basis	Special exemptions Disabled veterans	Widows	Aged	Handi cappe
Alabama	yes	Homestead exemption assessment based.	X		X	X
Alaska	no				X	
Arizona	no		X	X		
Arkansas	no					
California	yes	Annual income	X		X	
Colorado	no					
Connecticut	yes	Annual income	X		X	X
Delaware	no					
Florida	yes	Homestead exemption, income and assessment based	X	X	X	
Georgia	no		X		X	
Hawaii	yes	Homestead exemption assessment			X	
Idaho	no		X			X
Illinois	no		X		X	
Indiana	no		X		X	X
Iowa	yes	Homestead exemption income and assessment based	X		X	X
Kansas	no		X		X	X
Kentucky	no				X	
Louisiana	no		X			
Maine	no		X		X	X
Maryland	no		X		X	X
Massachusetts	no		X	X	X	X
Michigan	no		X		X	X
Minnesota	yes	Homestead exemption assessment based			X	
Mississippi	yes	Homestead exemption assessment based.			X	
Missouri	no				X	

(Continued)

Appendix Table 5. Continued

State	General property tax relief	Basis	Special exemptions: Disabled veterans	Widows	Aged	Handi-capped
Montana[1]						
Nebraska	yes	Homestead exemption assessment based.	X		X	
Nevada	no		X	X	X	
New Hampshire	no		X		X	X
New Jersey	no		X			
New Mexico	yes	[2]	X			
New York	no		X		X	
North Carolina	no				X	
North Dakato	yes	[3]	X		X	
Ohio	no				X	
Oklahoma	yes	Homestead exemption income and assessment based.				
Oregon	yes	Annual income	X			
Pennsylvania	no		X		X	
Rhode Island	no		X		X	X
South Carolina	no				X	
South Dakota	yes	Homestead exemption income and assessment based.			X	
Tennessee	no		X		X	
Texas	yes	Homestead exemption income and assessment based.	X		X	
Utah	no				X	
Vermont	yes	Homestead exemption[4]	X			
Virginia	no				X	
Washington	no				X	
West Virginia	no					
Wisconsin	no				X	
Wyoming	no		X			

SOURCE: Commerce Clearing House, *STATE TAX GUIDE*, All States version, March 1974.

[1] **Montana gives tax relief through variation in assessment rates.**

[2] **New Mexico gives a $200 exemption to every head of a household.**

[3] **North Dakota exempts only farm buildings and farm improvements.**

[4] **Only if the annual town meeting approves such an exemption in each town.**

Appendix Table 6. Millage rates used in taxing real property, by county, Mississippi, 1972.

County	Millage rates			County	Millage rates		
	Total	Exempt	Nonexempt		Total	Exempt	Nonexe
	(mills)	*(mills)*	*(mills)*		*(mills)*	*(mills)*	*(mill*
Adams	58.75	39.00	20.75	Leflore	55.40	36.65	18.7
Alcorn	75.25	40.00	35.25	Lincoln	66.48	40.00	26.4
Amite	54.00	38.00	16.00	Lowndes	60.27	38.50	21.7
Attala	64.25	39.00	25.25	Madison	65.50	29.00	26.5
Benton	59.80	42.75	17.05	Marion	53.30	37.00	15.3
Bolivar	53.99	37.85	16.14	Marshall	66.80	38.50	28.3
Calhoun	60.00	39.00	21.00	Monroe	61.80	39.10	22.7
Carroll	58.00	41.00	17.00	Montgomery	58.75	39.50	10.2
Chickasaw	68.10	40.00	18.10	Neshoba	67.25	40.50	26.7
Choctaw	58.75	40.00	18.75	Newton	68.75	41.00	27.7
Claiborne	60.00	29.50	20.00	Noxubee	44.75	33.25	11.5
Clarke	54.25	29.50	14.75	Oktibbeha	57.20	36.00	21.2
Clay	65.75	39.50	26.25	Panola	70.55	39.25	31.3
Coahoma	61.20	39.65	21.55	Pearl River	106.00	40.00	66.0
Copiah	63.31	40.00	23.31	Perry	66.75	42.00	24.7
Covington	62.50	40.25	22.25	Pike	56.25	39.00	17.2
DeSoto	67.20	39.00	28.20	Pontotoc	89.50	40.00	49.5
Forrest	61.35	29.25	22.10	Prentiss	83.25	41.00	42.2
Franklin	51.25	38.50	12.75	Quitman	61.30	40.20	21.1
George	67.00	41.00	26.00	Rankin	63.75	39.00	24.7
Greene	64.00	43.00	21.00	Scott	77.75	40.75	37.0
Grenada	59.00	38.00	21.00	Sharkey	51.18	36.50	14.6
Hancock	71.25	39.50	31.75	Simpson	63.00	39.50	23.5
Harrison	83.64	40.00	43.64	Smith	73.25	42.00	31.2
Hinds	63.95	39.75	24.20	Stone	74.25	38.00	36.2
Holmes	55.30	33.00	33.30	Sunflower	54.90	39.90	15.0
Humphreys	51.00	38.75	12.25	Tallahatchie	64.55	39.25	25.3
Issaquena	49.67	39.50	10.17	Tate	64.65	40.00	24.6
Itawamba	75.25	41.00	34.25	Tippah	71.70	41.00	30.7
Jackson	83.10	40.00	43.10	Tishomingo	83.00	42.00	41.0
Jasper	55.88	40.50	15.38	Tunica	52.65	38.60	14.0
Jefferson	54.40	40.00	14.50	Union	69.05	40.50	28.
Jefferson Davis	63.00	39.25	23.75	Walthall	56.00	39.00	17.
Jones	61.75	40.00	21.75	Warren	42.25	32.50	9.
Kemper	50.50	41.00	9.50	Washington	77.08	34.05	23.
Lafayette	83.45	39.50	43.95	Wayne	62.75	41.00	21.
Lamar	66.00	39.75	26.25	Webster	52.00	39.50	12.
Lauderdale	54.75	39.00	15.75	Wilkinson	47.50	32.75	14.
Lawrence	59.50	40.00	19.50	Winston	60.70	40.00	20.
Leake	68.70	41.00	27.70	Yalobusha	81.75	40.00	41.
Lee	69.96	40.00	29.96	Yazoo	52.50	38.00	14.

SOURCE: Analyses of Tax Levies for 1972, Homestead Exemption Division, Mississippi State Tax Commission.

County	Calculated revenue at 1972 assessment	Calculated revenue at 30% assessment	Change
	(dollars)	*(dollars)*	*(dollars)*
Adams	2,303,530	2,303,530	0
Alcorn	707,110	1,697,070	989,960
Amite	310,430	665,220	354,780
Attala	564,050	845,080	282,030
Benton	190,700	408,650	217,950
Bolivar	1,843,160	2,764,750	921,580
Calhoun	308,370	841,010	532,640
Carroll	305,630	416,760	111,140
Chickasaw	435,840	871,680	435,840
Choctaw	242,750	364,130	121,380
Claiborne	375,240	500,320	125,080
Clarke	421,580	872,870	551,290
Clay	497,860	863,340	365,480
Coahoma	1,940,470	2,910,700	970,230
Copiah	746,870	1,244,780	497,910
Covington	273,120	677,170	404,040
DeSoto	1,556,820	2,335,230	778,410
Forrest	1,791,240	3,133,620	2,342,390
Franklin	187,010	311,690	124,670
George	406,520	1,219,660	813,040
Greene	309,630	488,890	179,260
Grenada	474,010	1,085,510	611,500
Hancock	839,610	1,199,440	359,830
Harrison	4,377,380	13,132,150	8,754,770
Hinds	12,794,090	19,191,140	6,397,050
Holmes	991,120	1,292,760	301,640
Humphreys	577,930	866,900	288,970
Issaquena	203,600	321,470	117,870
Ittawamba	376,330	940,810	564,490
Jackson	5,203,140	6,503,930	1,300,780
Jasper	263,530	790,590	527,060
Jefferson	238,820	387,270	148,460
Jefferson Davis	241,480	482,960	241,480
Jones	1,801,740	3,378,270	1,576,520
Kemper	311,640	667,790	356,150
Lafayette	679,370	1,358,730	679,370
Lamar	346,700	1,040,090	693,400
Lauderdale	3,293,050	3,904,800	611,750
Lawrence	365,210	438,250	73,040
Leake	529,470	836,010	306,540
Lee	1,805,250	3,610,500	1,805,250
Leflore	2,263,590	2,716,310	452,720
Lincoln	714,330	1,648,450	934,120
Lowndes	1,581,120	3,388,120	1,807,000
Madison	1,008,540	2,327,400	1,318,860
Marion	763,080	1,144,630	381,540
Marshall	650,770	1,084,610	433,840
Monroe	786,780	2,034,760	1,247,990
Montgomery	365,720	548,580	182,860
Neshoba	432,080	997,110	565,030
Newton	672,170	1,008,250	336,080
Noxubee	346,190	451,550	105,360
Oktibbeha	824,480	1,301,810	477,330
Panola	801,450	1,658,170	856,720
Pearl River	1,445,100	1,970,590	525,490
Perry	245,860	388,200	142,340
Pike	1,352,310	1,622,770	270,460
Pontotoc	551,230	1,181,210	629,980
Prentiss	505,920	1,167,500	661,590
Quitman	686,070	1,029,100	343,030
Rankin	1,221,320	2,818,440	1,597,110
Scott	614,070	1,315,860	701,790
Sharkey	372,950	588,870	215,920
Simpson	460,530	986,850	526,320
Smith	363,030	640,640	277,610
Stone	296,630	635,630	339,000
Sunflower	1,328,090	2,213,480	885,390
Tallahatchie	545,710	1,036,150	490,440
Tate	574,740	1,044,980	470,240
Tippah	383,880	822,600	438,720
Tishomingo	367,580	1,185,730	818,160
Tunica	455,170	910,350	455,170
Union	555,580	1,075,310	519,730
Walthall	295,790	492,990	197,190
Warren	2,109,200	2,109,200	0
Washington	2,504,740	3,757,100	1,252,370
Wayne	390,490	780,990	390,490
Webster	313,200	447,420	134,230
Wilkinson	224,820	481,750	256,930
Winston	547,390	1,094,790	547,390
Yalobusha	344,250	607,500	263,250
Yazoo	717,400	978,280	260,870
State	82,414,700	141,960,410	59,545,710

Appendix Table 8. Millage rates, 1972, and rates required to raise equal revenue if property is assessed at 30 percent, by count Mississipppi.

	Millage rate				Millage rate		
County	1972 rate	Required at 30% assessment rate	Decrease	County	1972 rate	Required at 30% assessment rate	Decr
	(mills)	*(mills)*	*(mills)*		*(mills)*	*(mills)*	*(mi*
Adams	58.75	58.75	0	Lincoln	66.48	28.81	37
Alcorn	72.25	30.10	42.15	Lowndes	60.27	28.13	32
Amite	52.13	24.33	27.80	Madison	66.50	28.82	37
Attala	64.25	42.83	21.42	Marion	55.30	36.87	18
Benton	59.80	27.91	31.89	Marshall	66.80	40.08	26
Bolivar	53.99	35.99	18.00	Monroe	61.80	23.90	37
Calhoun	61.60	22.59	39.01	Montgomery	58.75	39.17	19
Carroll	57.60	42.24	15.36	Neshoba	67.25	29.14	38
Chickasaw	68.10	34.05	34.05	Newton	68.75	45.83	22
Choctaw	58.75	37.17	19.58	Noxubee	44.75	34.31	10
Claiborne	60.00	45.00	15.00	Oktibbeha	57.20	36.23	20
Clarke	54.25	23.51	30.74	Panola	70.55	34.10	36
Clay	65.75	37.92	27.83	Pearl River	106.00	77.73	28
Coahoma	61.20	40.80	20.40	Perry	61.45	38.92	22
Copiah	63.31	37.99	25.32	Pike	56.25	46.87	9
Covington	62.50	25.21	37.29	Pontotoc	89.50	41.77	47
DeSoto	67.20	44.80	22.40	Prentiss	76.25	33.04	43
Forrest	61.35	26.59	34.76	Quitman	61.30	40.87	20
Franklin	51.25	30.75	20.50	Rankin	63.75	27.63	36
George	63.40	21.13	42.27	Scott	77.75	36.28	41
Greene	64.00	40.53	23.47	Sharkey	54.35	34.42	19
Grenada	59.00	25.76	33.24	Simpson	63.00	29.40	33
Hancock	71.25	49.88	21.37	Smith	73.25	41.57	31
Harrison	83.64	27.88	55.76	Stone	74.25	34.65	39
Hinds	63.95	42.63	21.32	Sunflower	54.90	32.94	21
Holmes	66.30	50.83	15.47	Tallahatchie	64.55	34.00	30
Humphreys	57.00	34.00	17.00	Tate	64.65	35.56	29
Issaquena	49.67	31.46	18.21	Tippah	71.70	33.46	38
Itawamba	75.25	30.10	45.15	Tishomingo	83.20	25.79	57
Jackson	83.10	66.48	16.62	Tunica	56.25	28.12	28
Jasper	55.88	18.63	37.25	Union	69.05	35.68	33
Jefferson	54.50	33.61	20.89	Walthall	56.00	33.60	22
Jefferson Davis	63.00	31.50	31.50	Warren	42.25	42.25	
Jones	61.75	32.93	28.82	Washington	57.98	38.65	19
Kemper	50.50	23.57	26.93	Wayne	62.75	31.37	31
Lafayette	83.45	41.72	41.73	Webster	52.00	36.40	15
Lamar	66.00	22.00	44.00	Wilkinson	47.50	22.17	25
Lauderdale	54.75	46.17	8.58	Winston	60.70	30.35	30
Lawrence	59.50	49.58	9.92	Yalobusha	81.75	46.32	35
Leake	68.70	43.51	25.19	Yazoo	32.50	23.83	8
Lee	69.96	34.98	34.98				
Leflore	55.40	36.17	9.23				

SOURCE: 1972 rates from Analyses of Tax Levies for 1972, Homestead Exemption Division, Mississippi State Tax Commission.

Other rates from formula: $\frac{\text{Present Revenue}}{\text{Assessment at 30 percent}}$

County	Actual reimbursement[1]	Predicted	
		Reimbursement	Reimbursement plus state tax foregone
	(dollars)	*(dollars)*	*(dollars)*
Adams	404,594	600,740	669,396
Alcorn	198,415	456,066	506,740
Amite	93,286	200,039	223,573
Attala	153,299	224,175	249,795
Benton	54,873	116,095	128,079
Bolivar	312,226	524,235	586,183
Calhoun	96,783	251,195	279,903
Carroll	73,120	101,935	112,955
Chickasaw	120,880	223,524	248,360
Choctaw	87,514	125,388	139,320
Claiborne	81,997	83,232	96,288
Clarke	113,248	262,682	292,280
Clay	130,109	216,816	241,246
Coahoma	336,567	499,314	555,338
Copiah	206,952	346,320	384,800
Covington	89,026	223,028	247,638
DeSoto	358,406	671,825	748,605
Forrest	542,154	761,641	882,297
Franklin	58,192	96,997	108,243
George	92,495	270,414	299,648
Greene	62,195	105,495	116,315
Grenada	116,996	263,211	294,177
Hancock	136,776	188,345	209,567
Harrison	947,890	2,052,594	2,280,660
Hinds	3,093,778	4,495,187	4,998,145
Holmes	194,494	211,888	241,114
Humphreys	103,635	143,709	160,251
Issaquena	19,899	26,767	29,783
Itawamba	113,042	293,243	342,945
Jackson	1,033,989	1,341,792	1,490,880
Jasper	87,211	273,969	303,993
Jefferson	58,811	96,732	107,480
Jefferson Davis	78,977	157,303	175,153
Jones	535,342	978,552	1,087,280
Kemper	92,690	186,277	206,414
Lafayette	161,745	267,776	297,948
Lamar	87,050	269,859	300,053
Lauderdale	845,284	1,141,927	1,272,433
Lawrence	115,521	144,234	160,260
Leake	166,680	267,528	296,450
Lee	503,687	877,284	974,760
Leflore	326,775	496,213	526,697
Lincoln	196,890	448,722	498,580
Lowndes	504,294	781,028	871,582
Madison	196,278	335,725	389,441
Marion	237,515	382,668	429,052
Marshall	133,163	227,786	254,196
Monroe	239,338	580,291	646,421
Montgomery	112,492	166,513	185,275
Neshoba	156,738	344,615	382,381
Newton	210,921	306,582	339,726
Noxubee	86,878	120,949	137,489
Oktibbeha	246,357	353,648	397,854
Panola	170,947	375,642	418,268
Pearl River	224,422	280,026	311,140
Perry	58,705	108,604	120,036
Pike	437,673	552,720	615,888
Pontotoc	135,754	293,112	325,680
Prentiss	154,035	344,711	381,976
Quitman	117,137	154,411	171,473
Rankin	328,110	770,805	858,897
Scott	176,848	333,635	369,949
Sharkey	36,569	54,259	60,937
Simpson	132,567	286,822	319,140
Smith	111,822	198,056	218,904
Stone	55,913	118,626	132,582
Sunflower	252,545	389,210	432,576
Tallahatchie	92,937	162,379	180,805
Tate	143,747	250,866	278,740
Tippah	116,282	252,507	279,804
Tishomingo	81,598	304,665	336,735
Tunica	42,044	73,110	81,562
Union	153,322	302,913	336,109
Walthall	117,666	195,615	217,971
Warren	467,654	624,806	712,497
Washington	389,563	643,641	729,317
Wayne	103,408	211,178	234,007
Webster	119,906	174,074	193,688
Wilkinson	41,033	84,314	107,436
Winston	192,680	379,404	421,560
Yalobusha	79,910	143,478	159,420
Yazoo	248,570	360,587	403,009
State Total	19,590,844	32,991,248	36,815,521

[1] Total to counties and separate school districts.

SOURCE: Reimbursement figures from Mississippi State Tax Commission (19).

Appendix Table 10. Estimated costs of reevaluation by county, Mississippi.

County	Cost	Parcels	Average cost per parcel	County	Cost	Parcels	Average per pa
	(dollars)	*(number)*	*(dollars)*		*(dollars)*	*(number)*	*(dolla*
Adams	248,860.80	13,400	18.57	Lincoln	259,913.51	14,226	18.2
Alcorn	310,413.40	18,000	17.25	Lowndes	308,874.59	17,885	17.2
Amite	206,710.65	10,250	20.17	Madison	269,052.73	14,909	18.0
Attala	263,579.90	14,500	18.18	Marion	233,071.22	12,220	19.0
Benton	147,432.82	5,820	25.33	Marshall	270,270.40	15,000	18.0
Bolivar	329,267.23	19,409	16.96	Monroe	323,794.40	19,000	17.0
Calhoun	230,461.93	12,025	19.17	Montgomery	156,531.90	6,500	24.0
Carroll	173,927.20	7,800	22.30	Neshoba	203,365.40	10,000	20.3
Chickasaw	232,803.60	12,200	19.08	Newton	233,071.22	12,220	19.0
Choctaw	165,564.08	7,175	23.08	Noxubee	164,185.84	7,072	23.2
Claiborne	151,085.84	6,093	24.80	Oktibbeha	204,663.36	10,097	20.2
Clarke	200,649.06	9,797	20.48	Panola	237,085.52	12,520	18.9
Clay	182,223.42	8,420	21.64	Pearl River	300,297.36	17,244	17.4
Coahoma	238,156.00	12,600	18.90	Perry	149,841.40	6,000	24.9
Copiah	234,141.70	12,300	19.04	Pike	254,935.78	13,854	18.4
Covington	149,841.40	6,000	24.97	Pontotoc	196,139.66	9,460	20.7
DeSoto	310,413.40	18,000	17.25	Prentiss	243,508.40	13,000	18.7
Forrest	440,249.24	27,703	15.89	Quitman	129,127.61	4,452	29.0
Franklin	156,826.29	6,522	24.05	Rankin	432,421.36	27,118	15.9
George	179,279.60	8,200	21.86	Scott	200,153.96	9,760	20.5
Greene	122,276.54	3,940	31.03	Sharkey	116,241.71	3,489	33.3
Grenada	206,108.51	10,205	20.20	Simpson	216,331.59	10,969	19.7
Hancock	799,221.33	54,530	14.66	Smith	235,479.80	12,400	18.9
Harrison	939,320.40	65,000	14.35	Stone	136,460.40	5,000	27.2
Hinds	1,407,655.39	100,000	14.08	Sunflower	230,127.40	12,000	19.1
Holmes	171,826.39	7,643	22.48	Tallahatchie	175,265.30	7,900	22.1
Humphreys	185,341.20	8,653	21.42	Tate	170,729.14	7,561	22.5
Issaquena	81,009.54	856	94.64	Tippah	215,809.73	10,930	19.7
Itawamba	237,567.24	12,556	18.92	Tishomingo	259,231.08	14,175	18.2
Jackson	899,177.40	62,000	14.50	Tunica	198,160.09	8,490	21.5
Jasper	148,503.30	5,900	25.17	Union	250,118.62	13,494	18.5
Jefferson	124,765.41	4,126	30.24	Walthall	230,127.40	12,000	19.1
Jeff Davis	172,709.53	7,709	22.40	Warren	404,080.40	25,000	16.1
Jones	404,080.40	25,000	16.16	Washington	404,080.40	25,000	16.1
Kemper	154,337.42	6,336	24.36	Wayne	203,365.40	10,000	20.3
Lafayette	283,651.40	16,000	17.73	Webster	149,841.40	6,000	24.9
Lamar	183,293.90	8,500	21.56	Wilkinson	155,461.42	6,420	24.2
Lauderdale	467,640.15	29,750	15.72	Winston	203,365.40	10,000	20.3
Lawrence	176,603.40	8,000	22.08	Yalobusha	189,984.40	9,000	21.1
Leake	202,027.30	9,900	20.41	Yazoo	395,115.13	24,330	16.2
Lee	537,890.40	35,000	15.37				
Leflore	320,248.44	18,735	17.09	State Total	22,340,871.75	1,223,248	18.2

SOURCE: Number of parcels from Mississippi State Tax Commission.

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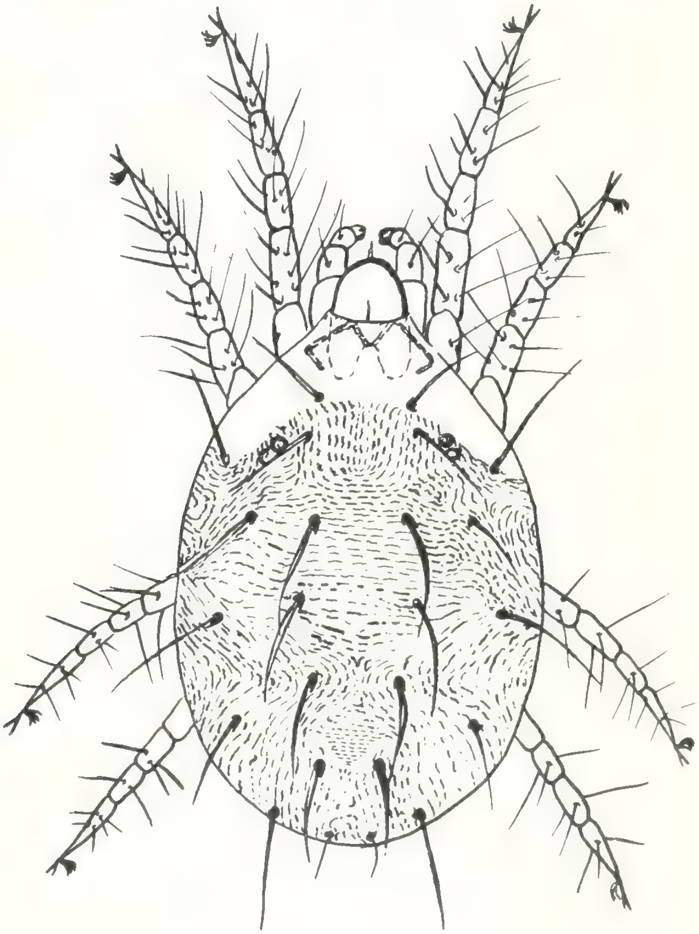
March 1976

Resistance To Twospotted Spider Mite In Cotton



by

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Resistance to Twospotted Spider Mite in Cotton

Resistance to the twospotted pider mite, *Tetranyuchus urticae* och, in certain cottons has been ported (Schuster et al. 1973). This lletin reports results of a connuation of research to detect pider mite resistance in cotton. It so reports the results obtained by edling screening of the mainder of the collection of the exas race of *Gossypium hirsutum* , the *G. barbadense* L. collection of the Fort Collins National Seed Depository, private collections of Dr. S. G. Stevens and a collection obtained from Dr. L. M. Verhalen of Oklahoma State University.

Since the last bulletin was issued additional research has made the scoring system more meaningful. Schuster and Cherry (1975) have shown that resistance to the twospotted spider mite used in these studies is indicative of resistance to the desert spider mite *Tetranychus desertorium* Banks. Furthermore, Schuster (1975) has shown that those varieties with a damage index of 4.0 have similar reduction of plant weight and lint weight and that the fruiting efficiency is greatly reduced. Those with damage index of 3.0 are intermediate but should not be considered resistant and those with a damage index of 2.0 are resistant.

Methods and Materials

The methods used in this study ere similar to those of the revious research. This study ffered in that a balanced fertilizer as added to each flat at two week tervals.

Materials were obtained through e efforts of the Technical Comittee of the Southern Regional esearch Project, S-77, Genetics and Cytology of Cotton II. Dr. P. A. Fryxell, United States Department of Agriculture, provided the seed of the race collection and the genetic marker collection maintained at Texas A&M University. The strains, varieties and marker stocks of *G. barbadense* collection were obtained from the Fort Collins National Seed Depository. Dr. S. G. Stevens provided seed of his personal collection from Colombia and Dr. L. M. Verhalen of Oklahoma State University provided recently collected *G. hirsutum* stocks of a diverse collection from several countries. A total of 568 stocks were evaluated for spider mite resistance.

Results

There were 75 races of *G. hirstum* with indices of 2.0-2.2, 147 th indices of 2.3-3.2 and 134 with idices greater than 3.3 (Table 1.). e previously reported 11 races at were considered resistant, us a total of 86 races of the 686 sted were resistant. Based on ta provided in ARS-H-2, The gional Collection of *Gossypium* rm plasm, the location of sistance was centered in Oaxaca, Mexico (24 lines). When combined with 7 Guerrero, Mexico resistant races, the total of 31 is far ahead of the five each found in British Honduras and Yucatan, Mexico. Nineteen of the resistant races were of the race Morrilli.

Most of the 166 *G. barbadense* varieties and races were resistant (Table 2.). The previous bulletin reported that 27 of the 29 tested were resistant. No pattern of susceptibility was evident.

All of the 11 *G. hirsutum* races collected in Colombia were susceptible (Table 3.). They were all race marie-galante.

None of the varieties of a worldwide collection of *G. hirsutum* were resistant (Table 3.). The strains Laxmi from India and 4S 180 from Greece were intermediate in resistance.

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Table 1.—Comparative spider mite resistance in wild races of *Gossypium hirsutum* and *G. barbade* in the S-77 collection at College Station, Tx.

Texas race no.	Race name[1]	Geographic origin[1]	Damage Index 25 days	45 da
8	Latifolium	Pueblo, Mexico	4.0	3.0
11	Morrilli	Oaxaca, Mexico	4.0	4.0
12	Richmondi	Oaxaca, Mexico	4.0	2.0
20	Unknown	Chiapas, Mexico	4.0	4.0
26	Punctatum	Chiapas, Mexico	4.0	4.0
32	Latifolium	Chiapas, Mexico	4.0	3.2
35	Latifolium	Chiapas, Mexico	4.0	4.0
51	Palmeri	Chiapas, Mexico	3.0	3.0
70	Latifolium	Guatemala	4.0	4.0
86		Guatemala	4.0	3.0
94	Punctatum	Guatemala	4.0	2.0
99	Latifolium	Guatemala	4.0	3.0
102	Latifolium	Guatemala	4.0	4.0
115	Punctatum	Guatemala	4.0	3.0
125	Morrilli	Oaxaca, Mexico	4.0	2.0
126	Morrilli	Oaxaca, Mexico	4.0	2.0
129	Morrilli	Oaxaca, Mexico	3.3	2.0
130	Morrilli	Oaxaca, Mexico	4.0	2.0
131	Morrilli	Oaxaca, Mexico	4.0	2.0
132	Morrilli	Oaxaca, Mexico	3.0	2.0
133	Morrilli	Oaxaca, Mexico	4.0	2.0
138	Morrilli	Oaxaca, Mexico	3.0	2.7
145	Richmondi	Oaxaca, Mexico	4.0	2.0
146	Morrilli	Oaxaca, Mexico	4.0	3.0
147	Morrilli	Oaxaca, Mexico	4.0	4.0
160	Latifolium	Oaxaca, Mexico	4.0	4.0
168	Latifolium	Guatemala	4.0	2.0
169	Latifolium	Guatemala	4.0	3.0
172	Morrilli	Oaxaca, Mexico	3.4	2.0
176	Latifolium	Guatemala	4.0	3.0
179	Latifolium	Guatemala	4.0	4.0
184	Marie-galante	Guatemala	4.0	4.0
185	Latifolium	Guatemala	4.0	3.0
189	Morrilli	Oaxaca, Mexico	4.0	2.0
190	Morrilli	Oaxaca, Mexico	4.0	2.0
191	Morrilli	Oaxaca, Mexico	4.0	2.0
194	Morrilli	Oaxaca, Mexico	4.0	3.0
202	Latifolium	Guatemala	4.0	3.0
207	Latifolium	Guatemala	4.0	4.0
210	Morrilli	Guatemala	3.0	2.0
230	Punctatum	Guatemala	3.0	2.0
249	Latifolium	Guatemala	4.0	3.0
252	Latifolium	Oaxaca, Mexico	3.0	2.0
254	Morrilli	Oaxaca, Mexico	4.0	3.0
256	Richmondi	Oaxaca, Mexico	3.0	3.0
257	Morrilli	Oaxaca, Mexico	3.0	4.0
260	Morrilli	Oaxaca, Mexico	4.0	4.0
261	Morrilli	Oaxaca, Mexico	3.0	3.0
263	Latifolium	Oaxaca, Mexico	4.0	3.0
264	Morrilli	Oaxaca, Mexico	3.5	3.0

Continued

ble 1.—Continued.

xas ce no.	Race name[1]	Geographic origin[1]	Damage Index 25 days	 45 days
268	Morrilli	Oaxaca, Mexico	3.5	3.0
271	Latifolium	Oaxaca, Mexico	4.0	2.0
276		Oaxaca, Mexico	3.0	3.0
278	Morrilli	Oaxaca, Mexico	4.0	2.0
280	Morrilli	Oaxaca, Mexico	4.0	3.0
284	Morrilli	Oaxaca, Mexico	4.0	3.0
285	Morrilli	Oaxaca, Mexico	3.0	2.0
289		Oaxaca, Mexico	3.0	2.0
290		Oaxaca, Mexico	3.0	2.0
292	Morrilli	Oaxaca, Mexico	3.0	2.0
295	Morrilli	Oaxaca, Mexico	3.0	3.0
296	Morrilli	Oaxaca, Mexico	3.0	3.0
322		Guerrero, Mexico	4.0	3.0
326		Guerrero, Mexico	4.0	3.0
329		Guerrero, Mexico	3.0	3.0
334		Oaxaca, Mexico	3.0	3.0
336		Guerrero, Mexico	4.0	3.0
339		Guerrero, Mexico	3.0	3.0
346		Guerrero, Mexico	4.0	3.0
347		Guerrero, Mexico	3.0	2.0
367	Marie-galante	Guatemala	3.0	3.0
368	Marie-galante	Guatemala	4.0	3.1
371	Marie-galante	Guatemala	4.0	3.1
379	Morrilli	Guatemala	3.0	2.0
390			3.0	2.0
396		Hopi M34-6-2-5	4.0	4.0
400		Hopi MB-3-5-7	4.0	4.0
401		Hopi New Mex.-2	5.0	—
458	Morrilli	Oaxaca, Mexico	4.0	2.8
459			4.0	3.0
464			4.0	3.0
475		Guatemala	3.0	2.5
477		Guatemala	4.0	2.2
478		Guatemala	3.0	2.0
479		Guatemala	4.0	4.0
492	Latifolium	Yucatan, Mexico	4.0	4.0
498		Russia	4.0	4.0
500	Latifolium	Yucatan, Mexico	4.0	3.0
570			4.0	3.0
610			4.0	4.0
616			4.0	4.0
625			4.0	4.0
657			3.0	2.0
662		Yucatan, Mexico	3.0	3.0
670			3.0	3.0
672		Yucatan, Mexico	3.0	2.0
680			3.0	3.0
687			3.0	2.0
690			4.0	2.0
693		Honduras	4.0	3.0
695		Honduras	4.0	4.0

Continued

Table 1.—Continued.

Texas			Damage Index	
race no.	Race name[1]	Geographic origin[1]	25 days	45 da
697			4.0	3.0
698		Honduras	4.0	4.0
699		Honduras	4.0	4.0
700		Honduras	4.0	3.0
704		Honduras	4.0	4.0
707		Honduras	4.0	4.0
710		Nicaragua	4.0	3.0
712		Nicaragua	4.0	3.0
713		Nicaragua	3.0	3.0
714		Nicaragua	4.0	2.0
717			4.0	4.0
720		Nicaragua	4.0	4.0
724		British Honduras	4.0	4.0
725		British Honduras	4.0	3.0
728		Mexico	4.0	3.0
730		Mexico	3.0	2.0
731		Mexico	3.0	3.0
732		Mexico	3.0	3.0
734		Mexico	3.0	3.0
737		Mexico	4.0	2.0
739		Morelos, Mexico	4.0	3.0
740		Jalisco, Mexico	3.0	2.0
741		Mexico	3.0	2.0
742		Mexico	4.0	2.0
743		Guatemala	4.0	3.0
744		Veracruz, Mexico	4.0	3.0
745		Yucatan, Mexico	4.0	2.0
746		Pubeblo, Mexico	3.0	2.0
748		Michoacan, Mexico	3.0	2.0
749		Veracruz, Mexico	3.0	2.0
750			4.0	3.0
751			4.0	4.0
752		Morelos, Mexico	4.0	3.0
753		Veracruz, Mexico	4.0	3.0
754		Veracruz, Mexico	4.0	3.0
755		Veracruz, Mexico	4.0	4.0
756		Veracruz, Mexico	4.0	3.0
757		Veracruz, Mexico	3.0	2.0
758		Veracruz, Mexico	4.0	3.0
759		Veracruz, Mexico	3.0	2.0
760		Veracruz, Mexico	3.0	3.0
761		Veracruz, Mexico	4.0	2.0
763		San Luis P., Mexico	3.0	2.0
764		San Luis P., Mexico	3.0	3.0
765		British Honduras	3.0	3.0
766		British Honduras	3.0	2.0
767		British Honduras	4.0	3.0
769		Chiapas, Mexico	4.0	4.0
770			4.0	4.0
771			3.0	3.0
773			4.0	4.0

Continued

ble 1.—Continued.

as ge no.	Race name[1]	Geographic origin[1]	Damage Index 25 days	45 days
76			4.0	4.0
79			4.0	4.0
83		British Honduras	4.0	4.0
84		British Honduras	4.0	4.0
85		British Honduras	4.0	4.0
86		British Honduras	4.0	4.0
87		British Honduras	3.0	2.0
88		British Honduras	3.0	2.0
89		British Honduras	3.0	2.0
790		British Honduras	3.0	2.0
791		British Honduras	3.0	2.0
792		British Honduras	3.0	3.0
793		British Honduras	3.0	2.0
794		British Honduras	3.0	2.0
795		British Honduras	4.0	4.0
799		Cuba	3.0	2.0
802		Cuba	3.0	2.0
804		Bahamas	4.0	4.0
805		Bahamas	4.0	3.0
806		Bahamas	3.0	3.0
807		Bahamas	3.6	3.0
808		Bahamas	3.0	3.0
809		Bahamas	3.0	3.0
810		Bahamas	4.0	3.0
811		Bahamas	4.0	3.0
812		Bahamas	4.0	3.0
813		Bahamas	4.0	3.0
814		Bahamas	4.0	3.0
815		Bahamas	4.0	3.0
817	Marie-galante	Nicaraugua	4.0	4.0
820	Marie-galante	Trinidad	3.0	2.0
834	Marie-galante	Venezuala	4.0	4.0
847	Marie-galante	Venezuala	3.0	3.0
881	Marie-galante	Puerto Rico	4.0	4.0
931		USSR	4.0	4.0
932		USSR	4.0	4.0
933		USSR	4.0	4.0
939			3.0	3.0
948			4.0	3.0
957			4.0	4.0
959			3.0	3.0
984			4.0	4.0
986			3.0	3.0
996			3.0	3.0
997			4.0	4.0
998			4.0	3.0
000			4.0	4.0
001			4.0	4.0
003			4.0	4.0
004			4.0	3.0
005			4.0	4.0

Continued

Table 1.—Continued.

Texas race no.	Race name	Geographic origin[1]	Damage Index	
			25 days	45 da
1006			3.0	3.0
1007			3.0	2.0
1008			4.0	4.0
1009			4.0	4.0
1010			3.0	3.0
1015			3.0	2.0
1020			4.0	4.0
1021			4.0	4.0
1025			3.0	3.0
1027			3.0	3.0
1028			4.0	3.0
1029			4.0	3.0
1032			4.0	3.0
1036			4.0	2.0
1040			2.0	2.0
1041			4.0	3.0
1042			4.0	4.0
1043			4.0	3.0
1045			3.0	2.0
1046			4.0	2.0
1049			4.0	2.0
1050			4.0	2.0
1053			4.0	3.0
1054			4.0	4.0
1055			3.0	2.0
1056			3.0	2.0
1057			3.0	2.0
1061			2.0	3.0
1062			2.0	3.0
1063			3.0	3.0
1064			3.0	2.0
1065			3.0	3.0
1066			3.0	3.0
1069			3.0	3.0
1076			4.0	4.0
1082			3.0	3.0
1083			4.0	4.0
1084			4.0	4.0
1085			3.0	4.0
1086			4.0	4.0
1091			3.0	3.0
1092			4.0	4.0
1094			4.0	3.0
1099			4.0	4.0
1100			4.0	4.0
1101			4.0	4.0
1102			4.0	3.0
1103			4.0	3.1
1105			4.0	4.0
1106			3.0	2.0
1107			4.0	3.0

Continued

ble 1.—Continued.

xas ce no.	Race name[1]	Geographic origin[1]	Damage Index 25 days	 45 days
108			4.0	4.0
109			4.0	2.0
111			3.0	3.0
112			4.0	4.0
114			4.0	3.0
115			4.0	4.0
116			4.0	3.0
117			4.0	3.0
118			4.0	3.0
119			3.0	2.0
121			4.0	4.0
122			4.0	3.0
123			3.0	2.0
124			3.0	2.0
125			4.0	3.0
126			4.0	4.0
127			4.0	4.0
131			4.0	4.0
134			3.0	2.0
138			3.0	3.0
139			3.0	3.0
141			3.0	3.0
142			3.0	3.0
143			4.0	3.0
144			4.0	2.0
145			3.0	3.0
147			4.0	4.0
148			4.0	3.0
150			4.0	3.0
151			4.0	4.0
152			4.0	3.0
154			4.0	3.0
155			3.0	3.0
156			4.0	4.0
157			4.0	4.0
158			4.0	4.0
159			4.0	4.0
160			4.0	4.0
161			4.0	4.0
162			4.0	4.0
163			4.0	4.0
164			4.0	4.0
165			4.0	4.0
166			4.0	4.0
167			4.0	4.0
168			4.0	3.0
169			4.0	3.0
170			3.0	3.0
174*			3.0	2.0
175*			3.0	3.0
176			4.0	4.0

Continued

Table 1.—Continued.

Texas race no.	Race name[1]	Geographic origin[1]	Damage Index 25 days	Damage Index 45 day
1177			4.0	4.0
1178			4.0	4.0
1179			4.0	3.0
1180			3.0	3.0
1182			4.0	4.0
1183			4.0	3.0
1189			4.0	4.0
1191			3.0	3.0
1192			4.0	4.0
1194			4.0	4.0
1195			4.0	4.0
1196			4.0	4.0
1197			4.0	4.0
1199			4.0	4.0
1201			4.0	4.0
1202			3.0	3.0
1203			3.0	3.0
1204			4.0	3.0
1205			4.0	3.0
1209			4.0	4.0
1210			4.0	4.0
1211			4.0	4.0
1212			4.0	4.0
1213			4.0	4.0
1214			4.0	3.0
1215			4.0	4.0
1231			4.0	4.0
1232			4.0	4.0
1233			4.0	4.0
1234			2.0	2.0
1235			2.0	2.0
1237			4.0	3.0
1238			4.0	3.0
1239			4.0	4.0
1241*			3.0	3.0
1242			4.0	3.0
1246			4.0	3.0
1247			4.0	4.0
1248			4.0	3.0
1249			4.0	4.0
1250			4.0	4.0
1251			4.0	4.0
1252*			4.0	3.0
1253*			3.0	3.0
1255*			4.0	4.0
1256*			3.0	3.0
1257			4.0	4.0
1258			4.0	3.0
1259			3.0	3.0
1264			4.0	3.

[1] Where there is no entry, race name and geographic origin either are unknown or there are printed data.

*Appear to be *G. barbadense.*

able 2.—Comparative mite resistance in the *Gossypium barbadense* collection in the Ft. Collins collection.

F. Collins No.	Geographic Origin	Damage Index 25 days	45 days
26669	Mexico	2.00	2.00
26670	Mexico	2.00	2.00
26671	Guatemala	2.00	2.00
26673	Guatemala	2.00	2.00
26675	Guatemala	2.00	2.00
26677	Guatemala	2.96	2.44
26678	Guatemala	2.00	2.00
26679	Guatemala	2.00	2.00
26680	Guatemala	2.00	2.00
26681	Guatemala	2.00	2.00
26682	Guatemala	2.00	2.00
26683	Guatemala	2.14	2.00
26684	Guatemala	2.30	2.00
26685	Guatemala	2.00	2.00
26686	Costa Rica	2.00	2.00
26687	Honduras	2.00	2.00
26688	Honduras	2.00	2.00
26691	British Honduras	2.00	2.00
26692	British Honduras	2.00	2.00
26693	British Honduras	2.20	2.00
26694	British Honduras	2.00	2.00
26695	British Honduras	2.00	2.00
26696	British Honduras	2.00	2.00
26697	Cuba	2.00	2.00
26698	Cuba	2.00	2.00
26700	Haiti	2.00	2.00
26701	Dominican Republic	2.77	2.00
26703	Guatemala	2.00	2.00
26704	Guadeloupe	2.00	2.00
26706	Guadeloupe	3.00	2.00
26707	Guadeloupe	3.00	2.00
26708	Martinique	3.00	2.00
26709	Martinique	3.00	2.00
26710	Dominica	2.00	2.00
26711	St. Lucia	3.00	2.00
26712	St. Lucia	3.00	2.00
26713	St. Lucia	2.00	2.00
26714	British Guiana	2.00	2.00
26715	British Guiana	2.69	2.00
26716	British Guiana	2.75	2.00
26717	British Guiana	2.60	2.00
26718	British Guiana	3.00	2.00
26719	Venezuela	2.00	2.00
6721	Colombia	3.00	3.00
6723	Colombia	2.00	2.00
6725	Ecuador	3.00	2.00
6726	Ecuador	2.00	2.00
6727	Ecuador	2.36	2.20
6728	Ecuador	2.00	2.00
6729	Peru	2.00	2.00

Continued

Table 2.—Continued.

Ft. Collins No.	Geographic Origin	Damage Index 25 days	45 da
26730	Peru	2.00	2.00
26732	Peru	2.00	2.00
26733	Peru	2.00	2.00
26734	Peru	3.00	3.00
26737	Peru	2.00	2.00
26738	Peru	2.00	2.00
26739	Peru	2.00	2.00
26740	Peru	2.00	2.00
26741	Peru	2.00	2.00
26742	Peru	2.00	2.00
26743	Peru	2.00	2.00
26744	Peru	2.00	2.00
26745	Peru	2.00	2.00
26747	Peru	2.00	2.00
26748	Peru	3.00	3.00
26749	Peru	2.00	2.00
26752	Bolivia	2.00	2.00
26754	Bolivia	2.00	2.00
26756	Bolivia	2.27	2.00
26757	Bolivia	2.00	2.00
26758	Bolivia	2.00	2.00
26759	Bolivia	3.00	3.00
26760	Bolivia	2.75	2.00
26761	Bolivia	3.00	2.00
26762	Bolivia	2.00	2.00
26762	Bolivia	2.00	2.00
26764	Bolivia	2.74	2.00
26765	Bolivia	2.22	2.00
26766	Bolivia	2.46	2.00
26767	Santacruz	2.00	2.00
26768	Santacruz	2.00	2.00
26769	Argentina	2.00	2.00
26771	Bolivia	2.82	2.00
26772	Bolivia	2.57	2.00
26773	Bolivia	2.73	2.00
26774	Bolivia	2.00	2.00
26775	Bolivia	2.00	2.00
26776	Argentina	2.00	2.00
26777	Argentina	2.00	2.00
26778	Argentina	2.00	2.00
26780	Argentina	2.00	2.00
26781	Argentina	2.00	2.00
26782	Argentina	2.54	2.00
26783	Argentina	2.00	2.00
26784	Argentina	2.00	2.00
26785	Argentina	2.00	2.0
26786	Argentina	2.00	2.0
26787	Argentina	2.00	2.0
26789	Argentina	3.00	2.0
26789	Argentina	2.60	2.0
26790	Argentina	2.00	2.0

Continued

ble 2.—Continued.

Collins No.	Geographic Origin	Damage Index	
		25 days	45 days
26791	Argentina	2.00	2.00
26792	Argentina	3.00	2.00
26793	Argentina	2.00	2.00
26794	Argentina	2.89	2.00
26795	Argentina	3.00	2.00
26796	Argentina	2.00	2.00
26797	Argentina	2.00	2.00
26798	Argentina	2.67	2.00
26799	Argentina	2.00	2.00
26801	Argentina	2.00	2.00
26802	Argentina	2.00	2.00
26803	Argentina	2.00	2.00
26804	Argentina	2.00	2.00
26805	Argentina	2.00	2.00
26807	Argentina	3.00	2.00
26808	Argentina	2.00	2.00
26809	Argentina	3.00	2.00
26810	Argentina	2.00	2.00
26811	Argentina	2.00	2.00
26812	Argentina	3.00	2.00
26813	Argentina	2.00	2.00
26815	Argentina	2.00	2.00
26816	Argentina	2.00	2.00
26817	Argentina	2.00	2.00
26818	Argentina	2.82	2.00
26819	Argentina	3.00	2.00
26820	Paraguay	3.00	2.00
26821	Paraguay	3.75	3.50
26822	Paraguay	2.00	2.00
26823	Paraguay	2.00	2.00
26824	Brazil	2.00	2.00
26826	Brazil	2.00	2.00
26827	Brazil	2.30	2.00
26828	Brazil	3.00	2.00
26829	Brazil	2.00	2.00
26830	Brazil	2.00	2.00
26831	Brazil	2.00	2.00
26832	Brazil	2.00	2.00
26833	Brazil	3.00	2.00
26834	Brazil	2.00	2.00
26835	Africa	3.00	3.00
26836	Africa	2.64	2.00
26837	Africa	3.25	2.25
26838	Africa	3.00	3.00
26839	Africa	3.00	2.00
6840	Africa	3.00	2.00
6841	Domains Sakel	2.00	2.00
6842	Lambert X1730	3.00	2.00
6843	Ethiopia	2.00	2.00
6844	East Bengal	2.00	2.00
6845	Nepal	3.00	3.00

Continued

Table 2.—Continued.

Ft. Collins No.	Geographic Origin	Damage Index 25 days	45 da
26846	New Guinea	3.00	2.00
26847	British Guiana	3.00	2.00
26848	British Guiana	2.22	2.00
26849	Yuma	2.00	2.00
26850	Old Pima	2.00	2.00
26851	SXP	3.00	3.00
26852	Amsak	2.00	2.00
26853	Pima 32	2.00	2.00
26854	Pima S-1	2.00	2.00
26855	Pima S-2	2.00	2.00
26856	St. Kitts	3.00	2.00
26857	Nevis 81	2.00	2.00
26858	Monseratt	2.00	2.00

Table 3.—Comparative spider mite resistance in race marie-galente collected by S. G. Stephens Colombia.

Stevens Number	Collection Local	Damage Index 25 days	45 da
H 427	Boqueron, Magdalena Valley	4.00	4.00
H 428	LaVictoria, Valle del Cauca	4.00	4.00
H 429	Daqua, Valle del Cauca	4.00	4.00
H 437	Cienagade Oro, Cordoba	4.00	3.67
H 445	Villavicencio, Mata	4.00	4.00
H 446	Roldonille, Valle del Cauca	4.00	4.00
H 467	Neiva, Magdalena Valley	4.00	4.00
H 470	Neiva, Magdalena Valley	4.00	4.00
H 478	Aipe, Magdalena Valley	4.00	4.00
H 479	Aipe, Magdalena Valley	4.00	4.00
H 487	El Giganta, Magdalena Valley	4.00	3.3

Tble 4.—Comparative spider mite resistance in various *G. hirsutum* stocks.

Cltivar	P.I. Number	Country of Origin	Damage Index	
			25 days	45 days
1C	361150	Greece	3.00	4.00
4180	361151	Greece	3.00	3.30
H 9	362157	Chad	4.00	4.00
BA 592	362158	Chad	4.00	4.00
Lcmi	367341	India	3.00	3.00
Lani	365529	Pakistan	4.00	4.00
Pk 51	365532	Pakistan	4.00	4.00
A 134	365527	Pakistan	4.00	4.00
LS	365530	Pakistan	4.00	4.00
M (NT Sind)	365531	Pakistan	3.75	4.00
SI4	365544	Thailand	3.69	4.00
SI2	365545	Thailand	3.00	4.00
An 333-61	365535	Mali	4.00	4.00
H 1	365534	Cameroon	4.00	4.00
13-F	274465	USSR	4.00	4.00
13-F	274466	USSR	4.00	4.00
10-F	324468	USSR	4.00	4.00
15-5	324469	USSR	4.00	4.00
C 349	324467	USSR	4.00	4.00
C-211	324466	USSR	4.00	4.00
73	362154	Bulgaria	4.00	4.00
51	362155	Bulgaria	4.00	4.00
95	365543	Bulgaria	4.00	4.00
29	365542	Bulgaria	4.00	4.00
11	362156	Bulgaria	4.00	4.00
A (67) M	365536	Uganda	4.00	4.00
B52/NC 63	365537	Uganda	4.00	4.00
B 68	365538	Uganda	4.00	4.00
(68) 36	365539	Uganda	4.00	4.00
(68) 41	365540	Uganda	4.00	4.00
U65	365541	Uganda	4.00	4.00
ar 627	Unknown	Zambia	4.00	4.00
2-7-1	356811	Australia	4.00	4.00
7-2	356812	Australia	4.00	4.00
307	365528	Pakistan	4.00	4.00
andri	Unknown	Pakistan	4.00	4.00

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Evaluation of Investments in Rice-Soybean Rotations in the Delta of Mississippi

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Evaluation of Investments in Rice-Soybean Rotations in the Delta of Mississippi

Removal of government restrictions on rice production triggered an increase in production in Mississippi---harvested acreage increased from 62,000 in 1973 to 108,000 in 1974 and 171,000 in 1975 [1, 2]*. A still larger acreage may be planted this year. Increases in acreage likely will be on land planted to rice for the first time and much of it must be put to grade ("formed"). Rice production also requires investment in irrigation wells and equipment for putting water on the growing crop. In addition, producers may find it to their advantage to provide on-farm drying and storage of any new production before selling it to a mill.

Farmers who are considering the production of rice for the first time or who are thinking of expanding their existing rice acreage need a basis for estimating the profitability of the investment required. This involves the formulation of their expectations of future conditions[1] and the incorporation of these into decision-making---a process that becomes more difficult when decisions involve a flow of returns over long periods of time, as is true for investments in rice production.

Objectives

Our study was designed to generate information to assist farmers in appraising the feasibility of investing in the land forming, the irrigation wells and equipment and the drying-storing facilities needed for an efficient rice operation. Specifically, our attempt was to determine the number of years required to "pay back" a given per acre investment in rice production or, alternatively, to determine the investment per acre that could be recaptured over a specified number of years.

Procedure and Sources of Data

ross income per acre was estimated for the years 1976-1990 for rice and soybeans grown in two rotations (Table 1), for continuous soybeans grown on clay soil and for solid cotton grown on clay soil. We assumed three yield levels[2] for each crop and converted production to value, using three different prices for each crop (Table 2).

Estimates of the cost of producing an acre of each crop in 1976 were made, based on production practices that we obtained from published reports of previous research [3, 4]. We used 1975 prices of production inputs except for those cost items with a machinery component, for which we used estimates of 1976 machinery and equipment prices provided by distributors in the area.

Variable costs ("direct expense") accounted for the bulk of the es-

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Numbers in brackets refer to literature cited at the end of this bulletin.

[1] *Their estimates of crop yields and of actual or relative prices for products produced and resources used in production and their expectations with regard to changes in laws, regulations and other man-made constraints that impinge either directly or indirectly upon the success of their venture.*

[2] *The yield of soybeans grown in rice-soybean rotation was assumed to be three bushels higher than that of soybeans grown continuously. This yield difference is reflected in the differences in net returns reported in Tables 4 and 5.*

timated total cost of producing each crop in 1976 (Table 3). However, our estimates do not reflect all fixed costs ("indirect expense") that would be entailed in bringing new land into a rice-soybean rotation.[3] Labor and machinery ownership and operation are the production items we expect to experience the grea cost increases in the next few ye consequently, costs of these it for 1977 and subsequent years increased over our 1976 estim by 2.5 percent per year pounded annually. Because no can be grown in the year when is being put to grade, a cost equ the net income that could been realized from producing tinuous soybeans or solid co was charged to the rice-soyb rotations in 1976.

Net income per acre from crop was calculated by subtrac total specified expenses in ea the 15 years from our estimat gross annual income.[4] Thus, ou timates of net income for solid ton and for continuous soyb are the returns to opera management, land and ge farm overhead. For rice

Table 1. Two Rice-Soybean Rotations, Clay Soils, Delta of Mississippi, 1976-1990.

Year	One Year Rice One Year Soybeans	One Year Rice Two Year Soybean
1	None (land forming)	None (land forming)
2	Rice	Rice
3	Rice	Rice
4	Soybeans	Soybeans
5	Soybeans	Soybeans
6	Rice	Rice
7	Soybeans	Soybeans
8	Rice	Soybeans
9	Soybeans	Rice
10	Rice	Soybeans
11	Soybeans	Soybeans
12	Rice	Rice
13	Soybeans	Soybeans
14	Rice	Soybeans
15	Soybeans	Rice

Table 2. Annual gross income per acre for rice, soybeans and cotton, specified product price yield situations, Delta of Mississippi, 1976-1990.

Product price	Rice yields (bushels)			Soybeans yields (bushels)			Cotton yields (pounds of lint)[1]		
	90	100	110	23	28	33	500	550	
				(Dollars)					
Rice:									
3.00	270.00	300.00	330.00						
3.75	337.50	375.00	412.50						
4.50	405.00	450.00	495.00						
Soybeans:									
4.50				103.50	126.00	148.50			
5.00				115.00	140.00	165.00			
5.50				126.50	154.00	181.50			
Cotton[2]:									
.40							238.75	262.63	2
.45							273.44	300.78	3
.50							308.13	338.94	3

[1]Includes the value of seed produced based on 1.55 pounds of seed per pound of lint.

[2]Price of cottonseed per pound was set at $.05, $.0625, and $.075 when lint prices were $.40, and $.50 per pound, respectively.

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[3] *The prorated annual cost of the investment in land forming, irrigation wells and equipment, and dry storing facilities is reflected in our comparisons of net returns from new rice-soybean rotation with ret from continuous soybeans and solid cotton (Tables 4 and 5).*

[4] *The results presented in Tables 4 and 5 were computed from the average net income for the years 1976-1*

ble 3. Estimated cost of producing one acre of rice, soybeans and cotton, usual input practices, y soil, Delta of Mississippi, 1976.

m	Rice [1] with per acre yields (bushels) of			Soybeans [2] with per acre yields (bushels) of			Solid cotton[3] with per acre yields (pounds of lint) of		
	90	100	110	23	28	33	500	550	600
	---------------(Dollars)--------------								
rect expense[4]	186.72	190.72	194.72	45.10	45.50	45.90	213.82	218.32	222.82
ked expense[5]	31.63	31.63	31.63	14.31	14.31	14.31	47.37	47.37	47.37
tal expense[6]	218.35	222.35	226.35	59.41	59.81	60.21	261.19	265.69	270.19

urce: [3] with 1976 estimates of machinery and equipment costs.

Rice behind soybeans with 110-120 DBHP tractor.

Continuous soybeans, 8 row-equipment.

Solid cotton, 38-40 inch rows, 8 row-equipment.

Includes direct expenses for tractor and equipment, special equipment, labor, production terials, variable harvesting costs, other miscellaneous production costs and interest on erating capital.

Includes ownership costs of tractor, equipment and special harvesting equipment. Does not in- de fixed costs on irrigation well, charges for land forming or fixed costs for drying and storage of e on the farm.

Sum of direct expense and fixed expense.

ybeans grown in a new rice- ybean rotation, however, our es- nates of net income are the fferences between gross income d specified costs. *(The prorated nual cost of the investment in nd forming, irrigation wells and uipment, and drying-storing facilities was not charged to the rice-soybean rotation, but is reflected in our comparisons of net returns from a new rice soybean rotation with returns from continuous soybeans and solid cotton.)*

We then subtracted from the estimated per acre net returns to soybeans and rice grown in a new rotation the estimated net returns from continuous soybeans and solid cotton. Finally, the differences in net income were discounted to their 1976 value, using discount rates of seven, nine and eleven percent as follows:

$$(1)\ V_o = \sum_{n=1}^{t} \frac{NI_{rn} - NI_{an}}{(1+i)^n}$$

Where V_o = the present value of the stream of per acre net income differences

NI_{rn} = the estimated net income per acre from a rice-soybean system of rotation in year n

NI_{an} = the estimated net income per acre from either the continuous soybean or solid cotton alternative in year n

n = a particular year in the planning period (n = 1, 2, . . . , t)

t = the planning period in years

i = the rate used to discount the stream of net income differences

$\sum_{n=1}^{t}$ = the summation of the discounted stream of per acre net income differences for any number of years up to t = 15 (i.e., the planning period is varied by years, 1, 2, 3, . . . , 15).

Table 4. Excess of Net Returns Per Acre From Two Rice-Soybean Rotations Over Continuous Soybeans, for Specified Yields and Prices of Rice and Soybeans and Specified Rates of Discount on Investment, by Number of Years Required to "Payback" Investment in Rice-Soybean Rotations, Clay Soils, Delta of Mississippi, 1976-1990*

	One Year Rice - One Year Soybean Rotation									One Year Rice - Two Year Soybean Rotation								
	26 bu. Soybeans - 90 bu. Rice 1/			31 bu. Soybeans - 100 bu. Rice 2/			36 bu. Soybeans - 110 bu. Rice 3/			26 bu. Soybeans - 90 bu. Rice 1/			31 bu. Soybeans - 100 bu. Rice 2/			36 bu. Soybeans - 110 bu. Rice 3/		
Year	4.50SB 3.00R	5.00SB 3.75R	5.50SB 4.50R	4.50SB 3.00R	5.00SB 3.75R	5.50SB 4.50R	4.50SB 3.00R	5.00SB 3.75R	5.50SB 4.50R	4.50SB 3.00R	5.00SB 3.75R	5.50SB 4.50R	4.50SB 3.00R	5.00SB 3.75R	5.50SB 4.50R	4.50SB 3.00R	5.00SB 3.75R	5.50SB 4.50R
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	(7% discount rate)																	
1	$-41	-52	-63	-62	-75	-88	-82	-98	-113	-41	-52	-63	-62	-75	-88	-82	-98	-113
2	-36	3	41	-53	-13	27	-70	-28	14	-36	2	41	-53	-13	27	-70	-28	14
3	-34	50	134	-48	42	132	-62	34	130	-34	50	134	-48	42	132	-62	34	130
4	-24	61	146	-38	53	144	-52	45	142	-24	61	146	-38	53	144	-52	45	142
5	-15	72	158	-29	64	156	-43	56	154	-15	72	158	-29	64	156	-43	56	154
6	-16	107	231	-28	105	238	-39	103	245	-16	107	231	-28	105	238	-39	103	245
7	-8	116	241	-20	114	248	-31	112	256	-8	116	241	-20	114	248	-31	112	256
8	-11	146	303	-20	149	318	-30	152	334	0	125	250	-12	123	257	-23	121	265
9	-4	154	311	-13	157	329	-23	160	342	-4	151	306	-14	154	321	-23	156	336
10	-9	178	364	-16	185	386	-23	193	409	3	158	314	-7	161	329	-16	164	344
11	-3	184	371	-10	192	394	-17	200	416	9	165	322	-1	168	337	-10	171	351
12	-8	204	416	-13	216	444	-19	227	473	3	185	366	-4	192	387	-12	198	408
13	-3	210	422	-8	222	451	-13	233	480	9	191	373	1	198	394	-7	204	415
14	-8	225	459	-12	240	493	-17	255	527	14	196	379	6	203	400	-2	210	421
15	-4	230	465	-8	245	499	-12	260	533	7	210	413	1	220	439	-5	230	465
	(9% discount rate)																	
1	$-40	-51	-62	-61	-74	-86	-81	-96	-111	-40	-51	-62	-61	-74	-86	-81	-96	-111
2	-35	1	38	-52	-14	25	-69	-29	12	-35	1	38	-52	-14	25	-69	-29	12
3	-34	46	126	-48	38	124	-62	30	121	-34	46	126	-48	38	124	-62	30	121
4	-24	57	138	-38	48	135	-52	40	133	-24	57	138	-38	48	136	-52	41	133
5	-16	66	148	-30	58	146	-44	50	143	-16	66	148	-30	58	146	-44	50	143
6	-17	98	213	-29	95	219	-40	92	225	-17	98	213	-29	95	219	-40	92	225
7	-10	106	222	-22	103	228	-33	100	234	-10	106	222	-22	103	228	-33	100	234
8	-13	132	276	-22	133	288	-32	135	301	-3	114	230	-15	111	236	-27	108	242
9	-7	138	283	-16	140	296	-26	141	309	-7	136	279	-16	137	291	-26	138	303
10	-10	158	327	-18	164	345	-26	169	364	-1	142	286	-11	143	298	-21	145	310
11	-5	164	333	-13	169	352	-21	174	370	4	148	292	-6	149	304	-16	150	316
12	-10	179	368	-16	188	392	-23	196	416	0	164	327	-9	168	344	-17	172	361
13	-5	184	374	-12	193	397	-19	201	421	4	168	332	-4	172	350	-13	177	367
14	-10	196	402	-16	207	430	-21	218	458	8	173	337	-1	177	354	-9	181	371
15	-6	200	407	-12	211	435	-18	222	462	3	183	363	-4	190	384	-12	197	405
	(11% discount rate)																	
1	$-40	-50	-60	-60	-72	-85	-80	-94	-109	-40	-50	-60	-60	-72	-85	-80	-94	-109
2	-35	0	36	-51	-14	22	-68	-30	9	-35	0	36	-51	-14	22	-68	-30	9
3	-33	43	119	-47	34	116	-61	26	113	-33	43	119	-47	34	116	-61	26	113
4	-24	52	130	-38	44	127	-52	36	124	-24	52	130	-38	44	127	-52	36	124
5	-17	61	139	-31	53	136	-44	44	133	-17	61	139	-31	53	136	-44	44	133
6	-18	90	198	-30	86	202	-42	83	207	-18	90	198	-30	86	202	-42	83	207
7	-12	97	206	-23	93	210	-35	90	214	-12	97	206	-23	93	210	-35	90	214
8	-14	119	252	-24	119	262	-34	119	273	-6	103	213	-18	100	217	-30	96	221
9	-9	125	258	-19	125	269	-29	125	279	-9	122	254	-19	122	264	-29	122	273
10	-12	141	294	-21	145	310	-29	148	325	-4	128	259	-14	127	269	-25	127	279
11	-8	146	300	-16	149	315	-25	153	330	0	132	264	-10	132	274	-20	132	284
12	-11	158	328	-19	164	347	-26	170	367	-3	145	293	-12	147	307	-22	149	320
13	-8	162	332	-16	168	352	-23	174	371	0	148	297	-9	151	311	-18	153	325
14	-12	172	354	-18	179	377	-25	187	400	3	152	301	-6	154	317	-15	157	328
15	-9	174	358	-16	182	380	-22	190	403	0	160	320	-9	164	337	-17	168	354

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* The results were computed from the average net income for the years 1976-1990.

	One Year Rice - One Year Soybean Rotation									One Year Rice - Two Year Soybean Rotation								
	26 bu. Soybeans - 90 bu. Rice [1]			31 bu. Soybeans - 100 bu. Rice [2]			36 bu. Soybeans - 110 bu. Rice [3]			26 bu. Soybeans - 90 bu. Rice [1]			31 bu. Soybeans - 100 bu. Rice [2]			36 bu. Soybeans - 110 bu. Rice [3]		
Year	4.50SB[4] 3.00R	5.00SB[4] 3.75R	5.50SB[4] 4.50R	4.50SB 3.00R	5.00SB 3.75R	5.50SB 4.50R	4.50SB 3.00R	5.00SB 3.75R	5.50SB 4.50R	4.50SB 3.00R	5.00SB 3.75R	5.50SB 4.50R	4.50SB 3.00R	5.00SB 3.75R	5.50SB 4.50R	4.50SB 3.00R	5.00SB 3.75R	5.50SB 4.50R
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	(7% discount rate)																	
1	$ 21	-11	-44	3	-33	-68	-15	-54	-93	21	11	-44	3	-33	-68	-15	-54	-93
2	86	82	78	73	70	66	61	58	55	86	82	78	73	70	66	61	58	55
3	144	167	190	137	163	190	130	160	190	144	167	190	137	163	190	130	160	190
4	208	214	220	203	212	221	198	210	222	208	124	220	203	212	221	198	210	222
5	268	259	250	265	259	252	262	258	253	268	259	250	265	259	252	262	258	253
6	316	328	341	317	335	352	319	341	364	316	328	341	317	335	352	319	341	364
7	370	370	369	374	377	381	377	385	392	370	370	369	374	377	381	377	385	392
8	412	430	448	419	444	469	426	457	489	422	409	396	427	418	408	432	426	420
9	460	467	474	469	482	495	477	496	515	460	464	469	469	479	489	477	493	508
10	496	520	543	508	540	571	520	560	599	507	501	494	517	516	514	427	531	534
11	541	554	567	554	575	596	567	596	624	552	535	518	563	551	539	574	567	559
12	572	600	628	588	626	663	604	651	698	583	581	578	597	602	606	611	622	633
13	613	631	650	630	658	686	647	684	721	624	612	601	639	634	628	654	655	656
14	639	670	702	659	701	743	679	731	783	661	642	622	678	664	650	694	686	677
15	676	699	722	697	730	764	717	761	805	687	679	671	705	705	704	724	731	737
	(9% discount rate)																	
1	$ 21	-11	-43	3	-32	-67	-15	-53	-91	21	-11	-43	3	-32	-67	-15	-53	-91
2	83	78	74	71	67	63	58	55	51	83	79	74	71	67	63	59	55	51
3	138	159	180	131	155	180	124	152	179	138	159	180	131	155	180	124	152	179
4	197	203	209	192	200	209	187	198	209	197	203	209	192	200	209	187	198	209
5	252	244	236	249	243	236	246	241	237	252	244	236	249	243	236	246	241	237
6	295	306	317	295	311	327	296	316	336	295	306	317	295	311	327	296	316	336
7	343	342	342	345	348	352	347	354	361	343	342	342	345	348	352	347	354	361
8	378	394	410	384	406	427	389	417	444	388	376	365	391	383	375	395	390	385
9	420	426	432	427	438	450	434	450	467	420	424	428	427	436	444	433	448	461
10	450	470	490	460	486	513	469	503	537	460	454	448	467	466	466	475	479	483
11	487	498	509	497	515	533	508	533	557	496	482	468	505	495	486	513	508	503
12	512	535	558	525	556	587	537	577	616	521	519	516	532	536	539	543	552	562
13	544	559	575	557	581	605	571	603	634	553	543	534	565	561	557	577	578	580
14	564	590	616	580	615	650	596	640	684	582	567	551	595	585	574	608	603	597
15	592	612	632	609	637	666	625	663	700	602	595	588	616	616	615	631	637	642
	(11% discount rate)																	
1	$ 20	-11	-42	3	-32	-66	-15	-52	-89	20	-11	-42	3	-32	-66	-15	-52	-89
2	80	76	71	68	64	59	56	52	48	80	76	71	68	64	59	56	52	48
3	132	152	171	125	148	170	118	143	169	132	152	171	125	148	170	118	143	169
4	188	193	198	182	190	197	177	187	197	188	193	197	182	190	197	177	187	197
5	238	230	222	234	228	222	230	226	222	238	230	222	234	228	222	230	226	222
6	276	286	295	276	290	303	275	293	311	276	286	295	276	290	303	275	293	311
7	318	318	317	319	322	325	320	327	333	318	318	317	319	322	325	320	327	333
8	349	363	376	353	372	391	357	381	405	357	347	337	359	352	345	362	358	354
9	385	390	395	390	400	410	394	410	424	385	388	390	390	397	404	394	407	418
10	410	426	443	417	440	463	424	454	483	417	412	408	423	423	422	429	433	436
11	439	449	459	448	463	479	456	478	499	447	435	424	454	446	438	460	457	453
12	460	479	498	470	496	522	480	513	547	467	465	462	476	479	482	484	492	500
13	485	498	512	495	516	536	506	534	561	492	484	476	502	499	496	511	513	515
14	501	522	543	513	542	571	526	562	599	516	502	489	525	517	509	535	532	428
15	522	539	555	535	559	583	548	580	612	530	524	518	542	541	540	553	558	562

* *The results were computed from the average net income for the years 1976-1990.*

[1] Compared with solid cotton yielding 500 pounds of lint per acre.

[2] Compared with solid cotton yielding 550 pounds of lint per acre.

[3] Compared with solid cotton yielding 600 pounds of lint per acre.

[4] Prices of lint were $.40, $.45 and $.50 per pound when soybeans and rice were priced at $4.50 - $3.00, $5.00 - $3.75, and $5.50 - $4.50 per bushel, respectively.

Application to Investment in a Rice-Soybean Rotation[5]

The discounted net incomes (Tables 4 and 5) represent the additional net income that would be available to repay the investment in land forming, irrigation wells and equipment, and drying-storing facilities.[6] Once these investments have been recaptured these additions to net income would become increased returns to operator management, land and general farm overhead.

Returns to investment and length of "payback" period---The results reported in Tables 4 and 5 may be used in two ways. Suppose that a soybean producer has been attaining yields of 28 bushels per acre. He is considering forming his land for rice production and using a rotation of rice in one year and soybeans in one year. He expects to average 100 bushels per acre from rice and 31 bushels from soybeans following rice in the rotation. He also expects to receive an average price of $5.00 per bushel for soybeans, $3.75 for rice. He wishes to know how much investment per acre for land forming, for an irrigation system and for drying-storing facilities could be paid back in six years, using a discount rate of seven percent. Looking at column (5) of Table 4, under the seven percent discount rate, he finds that an investment of $105 per acre could be repaid in six years.

Or suppose that the same producer estimates that he must invest $145 per acre to get into rice production and wishes to know how many years it will take to repay this investment under the yield, product prices and discount rate specified in the above example. In Column (5) of Table 4, under the seven percent discount rate, he finds that a payback period of eight years would be required to return the $145 investment. The repayment period and the investment required for other yield levels, for other prices of rice and soybeans and for a rotation of one year of rice and two years of soybeans can be determined for discount rates of seven, nine and eleven percent by interpreting Table 4 in the same manner. Table 5 contains the same information for producers who are considering a change from solid cotton to a rice-soybean rotation.

Price that rice must bring for rice-soybean rotations to compete with continuous soybeans---Rice would have to be priced at above $3.00 for a rice-soybean rotation to return a positive return on investment.
example, rice would have to br
$3.76 per bushel to recapture a $
investment per acre within
years, if soybeans bring $4.50 ar
nine percent discount rate is u
(Figure 1).[7] With this price
soybeans and the same disco
rate, rice would have to bring $
to return an investment of $100
acre in 12 years.

*Price that cotton must brin
compete with rice-soyb
rotations*---A price of only 20 c
per pound of lint[8] would be requ
for solid cotton yielding 500 pou
of lint per acre to compete effect
ly with the rice-soybean rotati
under conditions of $3.00 rice, $
soybeans, a $325 per acre inv
ment in a rice-soybean rotation
a two-year payback period wi
nine percent discount rate (Fi
2).[9] A lower investment in
soybean rotations and a lo
payback period would req
higher cotton prices for cotton t
main competitive, holding
other assumptions constant,
cotton still needs to bring onl
cents to compete with an inv
ment of $100 per acre in a
soybean rotation using a 15-
payback period.

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[5] *The results of this study are applicable only to situations where land forming is required for rice prod
tion.*

[6] *We believe that our estimates of profitability and of the lengths of "payback" periods are conservat
because we held yields and prices constant through 1990 while allowing labor and machinery ownership c
operation costs to increase by 2.5 percent per year compounded annually.*

[7] *The price of rice did not vary more than five cents per bushel above or below the curves shown in Figur
for the three yield situations and the two rice-soybean rotations.*

[8] *Includes the value of seed which was computed by adding 1.25 cents for each 5-cent increase in lint pr
(seed were considered to have no value with lint at 20 cents or lower).*

[9] *The price of cotton lint did not vary more than one cent per pound above or below the curves shown
Figure 2 for the three yield situations and the two rice-soybean rotations.*

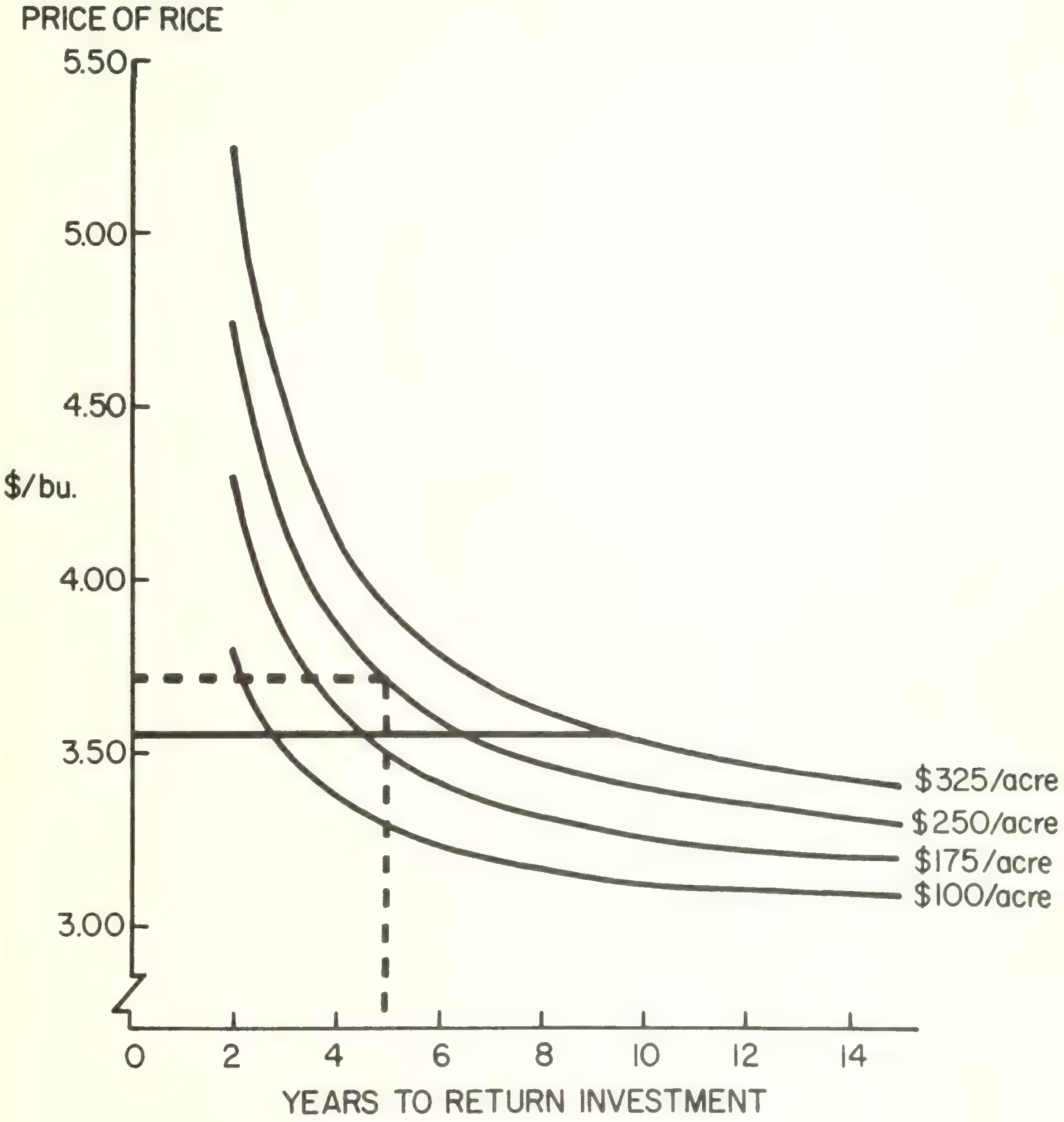

Figure 1. Price that rice must bring to return specified investments[1] in rice-soybean rotations, with $4.50 soybeans and a 9 percent discount rate, by years required to repay investment, clay soils, Delta of Mississippi.

[1] *An amount in addition to the net return from continuous soybeans yielding 23 bushels per acre and selling for $4.50 per bushel.*

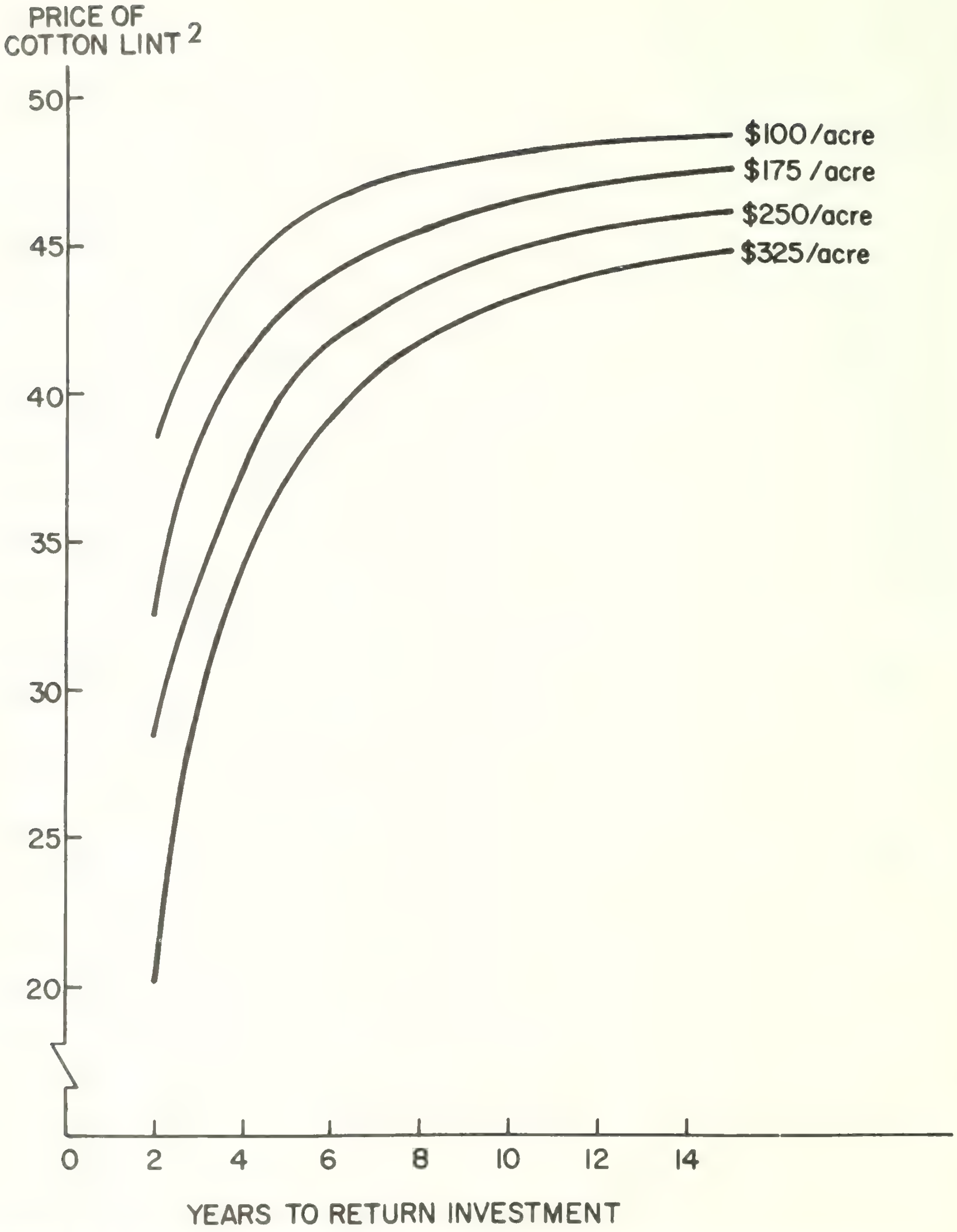

Figure 2. Price that cotton must bring to give a net return equal to the investment[1] in rice-soybean rotations, using a 9 percent discount rate, by years required to repay investment, clay soils, Delta of Mississippi.

[1] *An amount equivalent to the net return from rice-soybean rotations with 90 bushel rice at $3.00 and 26 bushel beans at $4.50.*

[2] *Includes the value of seed which was computed by adding 1.25 cents for each 5-cent increase in lint price (seed were considered to have no value with lint at 20 cents or lower).*

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The Broiler Industry: Status and Potential

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The Broiler Industry: Status and Potential

The rapid growth of the commer- al broiler industry in the United tates is generally recognized and ell documented (3, 4, 13, 16). Per apita consumption increased by lmost 60% between 1960 and 973—from 24.3 pounds to 38.3 ounds. This rapid growth in roiler production was accom- anied by substantial increases in e technical efficiency of both roduction and processing and by virtually complete vertical integration through the processor level.

Given the current status of the broiler industry, what is likely to occur in the future? More specifically, since the industry is essentially integrated through the processor level now, what structural changes are likely to occur in this sector? What structural configurations may be developed and where are they likely to occur? Is there likely to be additional integration into the marketing sector? In addition to the questions about the potential structure and organization of the industry, the question of the growth potential of the industry exists. What will be the form of the product? What product derivatives will be developed and what systems will be used for handling these products?

Study Objectives and Procedures

The study was initiated to rovide some indication of the otential of the Southern Broiler dustry. Specific objectives of the udy were to:

(1) *Review the existing organization of the industry with particular emphasis upon organizational and control arrangements, marketing policies and practices of firms.*

(2) *Examine internal and external structural factors influencing the demand for broilers and the supply response of firms to this demand.*

(3) *Examine alternative firm and structural arrangements in the industry and their potential impact on economic efficiency and attainment of market power, with special emphasis on the potential role of cooperatives and other arrangements currently developing within the industry.*

The procedures included determining current methods of operation by interviews with broiler processors in Mississippi. Fourteen individuals representing top management, research and trade associations also were interviewed to determine developments that they anticipate in the broiler industry. Heavy reliance was placed on historical data and on the results of previous supply and demand studies by the Department of Agricultural Economics of Mississippi State University.

Structure, Organization and Marketing Practices

The broiler industry has been escribed as a regionally- istributed partial bilateral ligopoly (with competitive inges) with relatively few buyers nd sellers (16). Competitive mphasis is on price and, buyers ave the overall power balance (6, 6). This power balance has been ranted to buyers by the broiler rms as a consequence of the rapid nfusion of technology that esulted in rapid expansion of roiler production and processing acilities.

The National Commission on Food Marketing in 1966 projected that 31 firms would handle 70% of the broiler volume in 1972 (13). This projection was virtually substantiated by a report indicating that 34 firms sold 70% of the broiler volume in 1970 (12). These studies also indicated that the largest firms are expected to handle larger shares of future output. Even so, the National Commission found that concentration in the broiler industry was low relative to other branches of food manufacturing.

Most firms in the broiler industry have a corporate type organization. Only four of the major firms in the United States are recognized as cooperatives and only two of these are in the top 25 firms (13). Integrated cooperatives account for only about 10 percent of the broiler output (15). An additional segment of the industry resembles the cooperative structure in that a small number of integrators participate jointly in a processing operation.

Mississippi Broiler Industry: The survey of 13 processor-integrators in Mississippi indicated that over 60 percent of these had expanded during the last five years. Additionally, three-fourths of those expanding had plans for additional expansions (5).

Minor differences existed in the method of integration, starting with the procurement of live birds for the processing plant.[1] Over two-thirds of the live birds were obtained from contract growers, Table 1. The major difference reported by firms was the higher percentage of supply obtained from contract growers by the medium size firms.

The 13 integrated operations studied in Mississippi reported similar patterns of production, processing and marketing. Differences were not important for large and small firms or for corporations and cooperatives.

One-fourth of the firms studied had processing capacities of 6,000 birds per hour or less and nearly 60 percent were at or above the 9,000 birds per hour capacity. For all firms, two-thirds of the birds processed came from within 25 miles of the plant and another 28 percent came from within a 50 mile radius - - - a somewhat smaller procurement area than was found in earlier studies (1).

Ninety-three percent of the broilers processed by Mississippi firms went to retail outlets through four intermediate channels. (Figure 1) Over one-third of the volume sold to retailers went directly from the processor to the retail outlet and 56 percent went through wholesaling intermediaries. The export market accounted for only slightly more than seven percent of the total volume marketed.

Broiler meat may be classified as either fresh or frozen or as whole and parts. Eighty-one percent of the production was marketed as fresh product; 19 percent as frozen, which is the form of most exports. More than 23 percent of the broilers were sold as parts, up four percent from the 1965 level (11). Expectations are that the proportion of cut-up will continue to increase, as evidenced by the growth of fast-food service and the decline meat-cutting at the supermar level.

The private survey of m merchandisers indicated the gr ing volume of broilers purchased individual parts or as whole cut (9). On the basis of tonnage so the volume moved as whole bi ranged from 30 to 60 percent, wh cut-up ranged from 10 to 25 perc and parts ranged from 25 to 60 p cent.

Price discovery remains a ma problem for the integrators. Pr reporting is adequately hand but it remains "after the fact" purposes of price decision-maki Most sales managers relied u their knowledge of immediate p prices, marketable volumes ticipated and telephone conta with other suppliers and w buyers. Most of the product is p ed and committed one week bef delivery. Some firms have repor price commitments two we before delivery (9), but this appe to be the maximum lead time all ed by buyers, due to the fluctuat broiler prices.

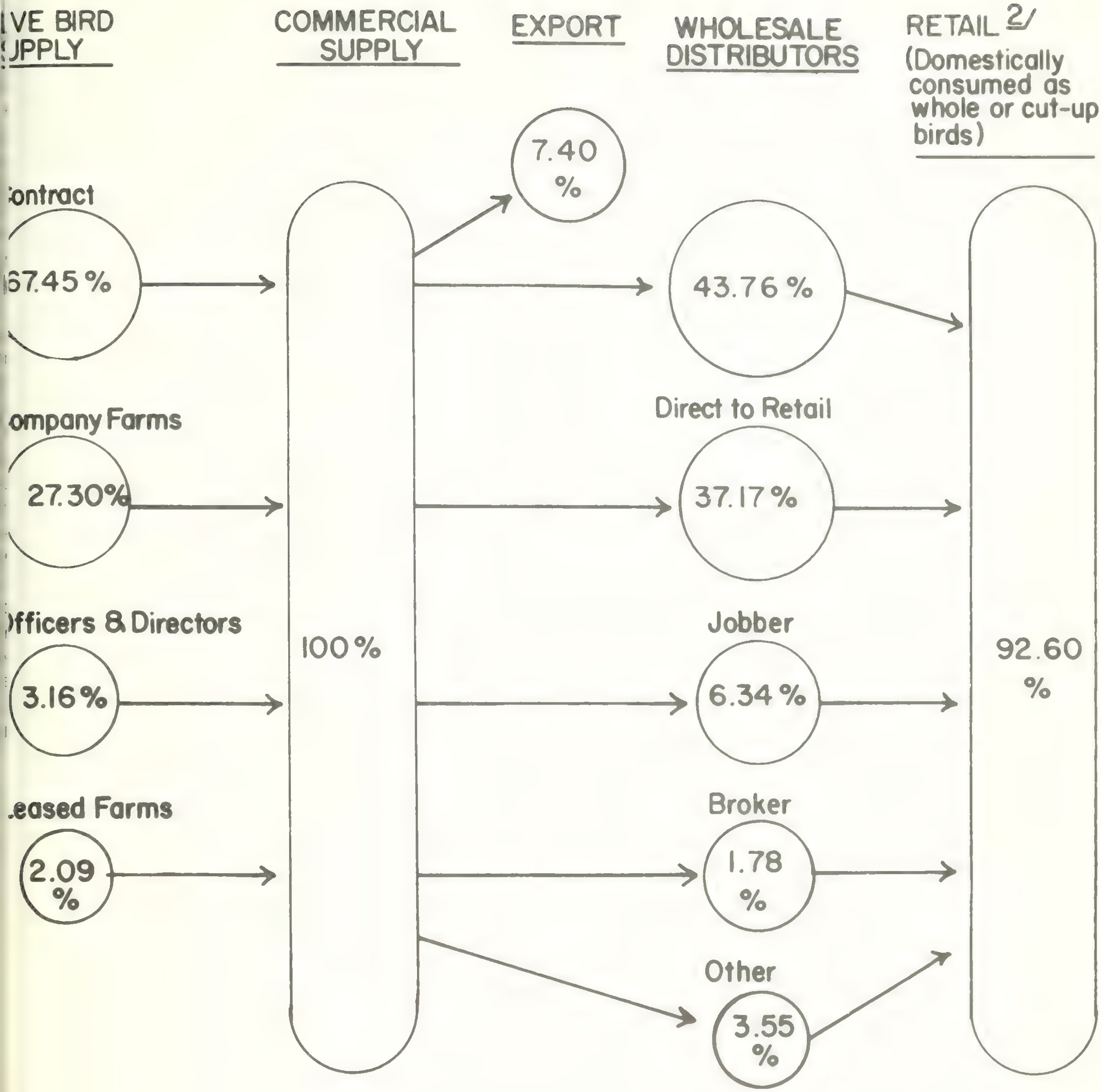
Table 1. Procurement of birds, by type of supplier, by size of firm, 13 broiler processing firms, Mississippi, 1971.

Type of supplier	Size of firm¹/ Small	Medium	Large	All firms
	- - - - - - - - - - -Percent-	- - - - - - - - - -		
Contract growers	39.48	94.18	71.82	67.44
Company farms	44.77	4.09	26.54	27.30
Company leased farms	7.05	1.73	.00	2.10
Officers and directors	8.70	.00	1.64	3.16
All sources	100.00	100.00	100.00	100.00

¹/ Small, 6,000 and less (rated capacity, per hour); Medium, 6,001 to 9,000 birds; Large, over 9,000 birds.

---

[1] *Breeder flocks, hatcheries and feed mills were all controlled by the integrator-processor. This repor focused on the processing and marketing phases.*


VE BIRD
PPLY
COMMERCIAL
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WHOLESALE
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RETAIL 2/
(Domestically
consumed as
whole or cut-up
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7.40 %
ontract
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ompany Farms
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fficers & Directors
3.16 %
eased Farms
2.09 %
100 %
43.76 %
Direct to Retail
37.17 %
Jobber
6.34 %
Broker
1.78 %
Other
3.55 %
92.60 %

igure 1. Major marketing channels for broilers, 13 processing firms, Mississippi, 1971.[1]

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[1] *Adapted from "The Chicken Broiler Industry: Structure, Practices, and Costs"; USDA, ERS, Marketing Research Report No. 930. P. 30, Figure 4, May 1971.*

[2] *Includes stores, institutions, and restaurants.*

Demand and Supply

The estimation of supply and demand functions and the question of potential demand for broilers and the supply capabilities of firms as viewed by the industry were examined. The latter approach solicited the greater reactions from industry personnel.

Supply and demand functions at the wholesale level were estimated with the use of a traditional two-equation model.[2] This analysis indicates that, in addition to the traditional relationships, distinct patterns of seasonality of price and quantity have existed. In fact, the patterns appear to be of such short duration that variations exist within seasons. In order to more appropriately account for these patterns, zero-one (dummy) variables were used for each month in each equation. Within the system postulated, demand shifted either positively or negatively while the slope of the demand function remained constant.

The results conformed to logical expectations: prices of broilers relative to quantities supplied are influenced importantly by costs, price expectations, pork prices, consumer incomes and population. Thus, short term marketing plans must be made with regard to shifts in price-quantity relationships and to shifts in prices of red meats (8). Longer-term market changes depend largely upon changes in the number and characteristics of the population (14). Higher incomes will influence broiler demand positively as long as real income levels trend upward. Even though demand for beef is currently slowing, the long term demand trend is still upward relative to other meats (14). The strength of this demand will affect the demand for pork and, hence, poultry meat, adversely.

An additional evaluation of broiler demand was provided by the industry survey. Fourteen industry leaders provided their expectations of the potential demand for: 1) all broilers, 2) portions (cuts) and 3) further processed broiler meat products.

All but one respondent expected the demand for broiler meat to increase at a rate approximating the growth rate of the past ten years. Also, they expected that the demand for cut-up broilers will increase at a faster rate than that for whole broilers.

Several processors already are producing for a pre-determined market (such as a particular chain) and are incorporating more and more product specifications. In fact, the willingness or ability to meet buyer specifications has become a point of competition among firms.

The fast food service industry has experienced substantial growth and this growth is expected to continue. Hence, the demand for broiler parts or cut-up birds can be expected to increase. Additionally, new developments and new interests in packaging by processors, along with a continued reduction of meat cutting by retailers, is expected to increase the output of pre-cut products by broiler processing plants (2, 10).

Opinions expressed with regard to the potential for growth in further processed broiler meat were less consistent. Most of those interviewed expect some growth in such products. But only one respondent was highly optimistic as to potential growth. Increases in consumer income generally have a positive influence on the demand for a product and forecasts by Jones support the expectations of continued growth in further processing, but at a relatively slow rate.

Industry View of the Future

The fourteen individuals representing management, research and trade associations, in addition to demand and supply expectations, voiced comments on:

1. possible improvements in operational practices and management,
2. potential of contracting with buyers,
3. potential for intrafirm ventures and linkages,
4. relative power position of processors versus retail buyers,
5. grow-out contracting versus company-owned farms, and
6. potential for cooperative firm organization.

Operational Practices and Management: Expectations about changes in management and operating practices revolve around potential gains in efficiency from upgrading management, streamlining marketing and advancing automation. All respondents view future efficiencies as those that will slow the rise in total costs as opposed to lowering unit costs of processing.

One key word summarizes expectations—automation. Automation will be necessary, both in handling live birds and in cessing plants. Industry per- nel point to the problems with or—shortages, turnover and senteeism--as the major im- us for the continued search for omation. Thus, labor problems her than direct labor costs are source of inefficiencies (and nce, higher indirect costs). spondents expect the productivi- of the remaining labor force, in nbination with new equipment, be higher than current levels.

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[2] *For detail see: Reece, Jerome, "Analysis of Selected Factors Influencing the Supply of and Demand for Broilers," unpublished M.S. Thesis, Department of Agricultural Economics, Mississippi State University, December 1974.*

ther potential areas for efficien- gains include improved manage- nt and improved marketing ctices. In-plant automation is pected to improve overall work- conditions. Management will better trained in both technical tters and in personnel manage- nt. Some individuals indicated t more decentralized manage- nt authority and responsibility, he various stages and in multi- nt operations, will improve nagerial efficiency.

ome respondents indicated that nagement is becoming more rket oriented as the industry ves into "second generation nagement." This management up is relatively better trained in rket planning than are their decessors. The increasing rket orientation will include mpts at more coordination, amlining and direct marketing. iciency gains are possible ough the use of a standard cut- broiler. Standardization is a ans of streamlining marketing l creating production economics machine manufacturers.

uyer-Contracting: Retail ers of broiler meat generally e the balance of power and e little incentive to enter into g range contracts with pliers. Additionally, neither ers nor sellers have much in- tive to contract as a conse- nce of widely fluctuating prices n week to week.

he major exception is negotia- with institutional buyers for volume contracts with price to be determined on a formula basis according to current market prices. Most of these arrangements are used for specific cuts (such as portions used by fast food outlets), for locally accepted brands or for prepackaged products. As market demands increase for cut-up and pre-packaged broilers, the need for steady and dependable suppliers tends to increase. However, the consensus is that basic product contracts with price to be determined in accordance with market price likely will remain as the predominant type of contract.

Intrafirm Linkages: The consensus is that prospects for linkages are slight regarding the ready-to-cook broiler product. Marketing of this product is reasonably competitive and leaders expressed the desire to remain independent. A possible exception may be joint venture activity for regional or national promotional activities.

Prospects for additional linkages or joint ventures are better in the area of processing and marketing speciality items in the "further-processed" category. The basic reason expressed for this possibility is the need for scale-economies and risk-sharing for new products. However, some respondents indicated that small-to-medium sized firms have had better success with speciality products and that the processing and marketing activities associated with these products do not lend themselves to larger scale plants or large market areas.

Recycling poultry waste as feed or fertilizer materials appears feasible. Joint activity is likely in the processing and handling of waste products. Even if the waste products are not reusable, some joint effort is still possible in establishing waste treatment facilities.

The best potential for joint ventures in the broiler industry is in the area of supplying inputs. Recent examples of such efforts are the market information inputs from the National Broiler Marketing Association, centralized fish meal purchasing, centralized purchasing of plastic coops and the soybean processing facility planned for Vicksburg, Mississippi. It is also noted that NBMA and the soybean processing plant are both formed as organizations with cooperative features.

Retail Power Versus Seller Power: Retailers currently have the power balance, according to the respondents. Any deviation from their normal or expected purchasing pattern can either create a strong demand or cause a back-up in the broiler pipelines.

All respondents expect retailers to continue to have the balance of power, although some modifications are expected. Two factors may bring modification or a lessening of the retail power position: 1) the trend toward a stronger demand for more cut-up broilers, and 2) supply management by processors. The demand for parts continues to increase while retailers are doing less cutting. Thus, more coordination will be necessary between buyers and sellers. Processors have probably been partly responsible for allowing retailers to have the power balance. Supply management will give the processor more control over the market and result in reducing the influence of the retailer.

Company Owned Farms Versus Contracts: Currently, a majority of broilers are grown under contract with growers. The industry leaders anticipate very little change, primarily because the capital investment required to move to company-owned farms can be put to better use elsewhere. Alternatives include expenditures for automated plants and waste treatment facilities. Disease problems in complexes and the difficulty of finding competent management were other reasons given. For the near future, contracts appear to be satisfactory and most firms have a waiting list of competent growers. In the distant future, if new firms enter or existing firms relocate, a strong possibility would be company-owned broiler complexes with all operations at a single site.

Potential Role of Cooperatives: Using the term cooperative to indicate a form of internal organization and ownership, no change is expected in the broiler industry. Collective action on the part of growers may increase but it is expected to focus upon terms of contract (bargaining) rather than collective action for cooperatively moving into processing and marketing. However, integrators do not expect a great deal of collective bargaining by growers---especially since most firms have a grower waiting list.

Cooperative action, cooperative efforts, or cooperative joint ventures may take a different direction (10). Cooperative organizations, such as the National Broiler Marketing Association (NBMA), are expected to have an increasing influence on the broiler industry.

The majority of respondents indicated that NBMA had helped the industry by its educational programs (marketing patterns, price-quantity relationships and relationships with other segments of the food industry). In addition to its informational efforts, NBMA has been successful as a central agent in the acquisition of selected inputs and as a central agency for pooling products for export. Thus, a cooperative venture for supplying market information and
operating supply and market
cooperative has been success
and is expected to be of greater
portance.

Joint procurement of inp
probably offers the best poten
for cooperative organization.
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operations. Some respondents
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were just as efficient as la
plants in "further processing'
broiler meat. Thus, the prim
potential for cooperation will b
input procurement followed
coordinated activities
marketing ready-to-cook produ

Summary and Conclusions

Broiler processing firms continue to get larger and the broiler industry somewhat is concentrated, but it does not represent a strong oligopolistic situation.

Grocery retailing appears to be more concentrated than the broiler processing industry—especially in regional and local market areas. This, plus the influence of national chains, generates a power balance in favor of the retail outlets. Added to this buyer segment is the highly concentrated fried chicken, fast-food industry which absorbs a substantial portion of the broiler output.

Fresh product for consumption is largely undifferentiated. Even where quality differences are present, consumers are generally unable to detect the better quality product. This is a major factor hindering the development of long-term contracting between processors and retailers. Retailers are generally reluctant to become dependent upon a single supplier of an undifferentiated product.

Broiler consumption follows a fairly consistent seasonal pattern, and a similar supply pattern has developed. These consistent market patterns are likely to remain strong. Overall, demand will probably remain reasonably strong in the future considering the relative price position of broilers and the projected short supplies of red meat. Minor changes in market patterns may occur which will add some stability to the marketing process. These will be due to increased sales of cut-up broilers, increase in processed products and continued promotional campaigns directed to the various year round methods of preparing chicken.

Thus, two major shifts related to the broiler product are visualized. One is a desire to move away from fresh undifferentiated broilers in order to gain market premiums associated with the competitive advantage of brands. The other appears to be an interest in shifting the total demand curve outward. Opportunities to lower broiler cost have largely been exploited and much of the consumption increases gained from lower relative p
have already been achieved.

The industry repeatedly has
documented as being highly
tically integrated, regardless o
type of ownership. This would s
to imply a strong degree of co
over the production and marke
system. However, vertical inte
tion is not complete and th
dustry consensus is tha
probably will not be com
through the retail stage. The
tions at the integrator level
either through ownership or
tracts, but marketing function
largely handled via spot tra
tions. Broiler firms are beco
more market oriented, yet th
dustry presently has little co
over marketing. Thus, there i
opportunity for cooperative ef
in this area.

Further coordination of
broiler industry offers pote
and the industry goal of stal
can probably be partially achi
by more horizonatal coordin
at some stage in the system.
National Broiler Marke

ociation is one such example of kind of horizontal coordination t may be effective in achieving rket stability. Another example he cooperative effort in the ac- sition of common inputs.

potential exists for some perative action in handling the rketing functions and a onger potential exists for improved procurement of inputs. Yet, the question of whether or not this potential will be realized depends upon forces outside the broiler industry. The definition of a "producer" remains unsettled and the outcome of the anti-trust suit pending against NBMA will significantly affect future structural changes. With increasing market orientation and the low margins prevailing, there appear to be potential gains from increased vertical and horizontal coordination. Although the exact form of organization to achieve coordination is unknown, the potential exists for "cooperative action."

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CHANGES IN QUALITY OF LIFE IN MISSISSIPPI: 1960-1970

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Bulletin 824

Changes in Quality of Life in Mississippi: 1960-1970

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March 1975

Preface

This is the first of five reports dealing with selected aspects of the quality of life in Mississippi. Included in this report is statistical information for the State as a whole. The four reports to follow contain information on counties grouped according to Districts of the Cooperative Extension Service.

Because quality of life is a complex phenomenon, no claim is made that this report presents a complete picture. It is based, however, on the assumption that part of quality is reflected in quantity. When it is observed, for example, that median family income for Mississippi families more than doubled during the 1960's and that the magnitude of the increase exceeded the rate of inflation, it is apparent that quality of life improved, at least in the sense that the families are able to afford more of the goods and services available in the marketplace.

Not all of the indicators are positive. There are still many families with incomes below the poverty level, and there are still people with limited education. This series of reports attempts to show both the positive and negative changes in the quality of life for Mississippians in the 1960's. This particular report is designed primarily to orient the reader to some of the general state-wide trends. The four reports to follow will be more detailed and therefore the information should be of more use to personnel in action agencies working on a county or regional, rather than a state-wide, basis

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Summary

In this bulletin we present some quantitative measures of the quality of life in Mississippi, namely, family income, family poverty, employment, education, housing, health, and welfare. Of particular interest are changes in these measures. In general, based on these, the quality of life in Mississippi improved between the last two censuses.

All of the economic indicators showed an improvement. Median family income more than doubled while the number of families classified as poverty families dropped from just over 50 percent of the families to 29 percent.* The labor force increased by 6 percent while unemployment dropped from 5.4 percent in 1960 to 5.0 percent in 1970. Even though the economic indicators show an improved quality of life, the income levels of blacks and females continued to lag behind those of whites and males.

The educational level of Mississippians also improved between 1960 and 1970. When this improvement is viewed in light of the fact that Mississippi does not have a compulsory school attendance law, it takes on additional significance.

If "one's home is one's castle," the quality of housing for Mississippians should be closely related to their quality of life. Home ownership increased for all categories of Mississippians examined (rural - urban and white - black). Examination of plumbing facilities and the number of persons per room showed that there was a substantial increase in the number of houses with hot and cold piped water and a substantial decrease (except in urban areas) in the number of houses with no piped water. With respect to number of persons per room, the results showed a decrease in every category, indicating a decrease in crowded homes between 1960 and 1970. Household conveniences that make life more comfortable; e.g., clothes washers and dryers, home freezers, and T.V., increased for all types of Mississippians in the 1960's.

The health indicators examined showed a decrease in the infant mortality rate; this lower rate may indicate better health facilities, a better home environment and better access to health facilities. In addition, health facilities for the aged and infirm increased considerably in the 1960's. The only area where little or no progress was made between 1960 and 1970 was in the number of doctors and dentists per 1,000 population and in the number of hospital beds per 1,000 population.

Welfare payments, on the average, increased between 1960 and 1970. The increase was greater than the increase in the cost of living index for the same period, indicating that Mississippians receiving public assistance experienced an increase in their quality of life in the 1960's.

These indicators show that in general, the quality of life for Mississippi families has improved. One must be careful when looking at general trends, however, because even though the criteria examined indicate that most Mississippians experienced an improvement in the quality of life in the 1960's, this does not mean that all groups benefited equally or that some groups did not actually experience a decrease in their quality of life.

**This drop may be due in part to the new index used by the U. S. Bureau of Census.*

Changes in Quality of Life in Mississippi: 1960-1970

According to the National Goals search Staff, "concern about at is now called 'quality of life' is t new in American life, and rare- has anyone advocated national licies to promote growth only for own sake."[1] Until recently, wever, widespread acceptance of ntinued economic growth as a tue apparently has been based the assumption that progress n be measured in terms of quan- ative growth.

The recent surfacing of interest quality of life must be viewed in a sitive way, but this interest must t be allowed to overshadow in- rest in the quantitative aspects of e, because in many respects antity reflects quality. When it is inted out, for example, that illions of families in the United ates live in poverty (defined in rms of income), the conclusion is avoidable that quality of life for em must be something less than sirable. Not only is the existence f poverty a contradiction of merican values; it also is a egative commentary on the merican economic and political ystems.

Those who operate within the framework of national policy and with a normative commitment to alleviating poverty, often ask what they can do to improve quality of life in Mississippi. This question poses two major problems: One of these pertains to the complexity of the term "quality of life."[2] Because it defies precise definition, except at the individual level, persons who "engage the enemy," so to speak, find themselves in a maze of perceptions, ideas and notions that do not coincide at all points. Thus they are faced with seemingly insurmountable barriers at the outset.

The other problem is that of deciding where limited resources can be utilized most effectively as inputs. This problem is particularly acute for USDA personnel who must function within the constraints of time and fund limitations. On the other hand, USDA personnel, especially those involved in research at Agricultural Experiment Stations and those involved in action programs in the Cooperative Extension Service, do have the advantage of experience in dealing with social and economic problems. The value of this experience, however, is vitiated to some degree by the fact that quality of life is so complex.

Planners can, however, move beyond these difficulties through the use of partial data for arriving at definitive insights and decision-making. This does not solve the problems, but it does enable researchers and action agency personnel to function within the parameters of the problems.

The use of partial data is nothing more than the examination of some of the information that pertains to quality of life. Examination, of course, implies something more than simply observing facts and figures. For planning purposes, researchers and action agency personnel must examine the information from a normative perspective. That is, they must ask what the information means in terms of their efforts to alleviate conditions that constitute negative aspects of quality of life or that act as barriers to improvement of that quality.

Purpose

The purpose of this report is to esent quantitative information bout various aspects of quality of fe in Mississippi. Included in the port is information pertaining to income, poverty, employment, education, housing, health, and welfare. Two main objectives guided the compilation of statistical data for the report: (1) providing a statistical description of social and economic conditions in Mississippi, and (2) providing a measure of change in those conditions over a ten-year period.

Quality of Life Indicators

Economic Indicators---One f the most widely used measures of he state of any society is that class f indicators of production, distribution, and consumption of goods and services. At the national level the GNP (Gross National Product) and the GNI (Gross National Income) are summary measures of the "state of the nation" in economic terms.

Although gross measures of per-

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[1] **Toward Balanced Growth: Quantity with Quality.** *A report to the President by the National Goals Research Staff, July 1970, U. S. Government Printing Office, Washington, D. C., P. 25.*

[2] *For an attempt to explicate the term, see Ronald C. Powers, "What Is Quality Life-Conflicts in Values,"* **Achieving Quality of Life in the Countryside.** *Proceedings of Forty-sixth Conference of the American Country Life Association, Inc., Ames, Iowa.*

Table 1. Median Family Income By Age, Place of Residence, Race and Sex of Household Head, Mississippi, 1969.

Age and Place of Residence	White		Negro	
	Male	Female	Male	Female
	$	$	$	$
All Families				
Under 25 years old	6,083	2,925	3,904	1,166
25-34	8,671	3,829	4,817	1,771
35-44	9,746	4,661	4,743	2,035
45-64	8,428	4,990	3,789	2,100
65 and older	3,162	3,527	1,969	1,761
Urban				
Under 25 years old	5,963	1,880	4,466	1,487
25-34	8,706	2,525	5,873	1,924
35-44	10,000	3,261	5,833	2,274
65 and older	3,697	2,914	2,515	2,049
Rural Nonfarm				
Under 25 years old	5,604	1,428	3,634	950
25-34	7,238	2,116	4,232	1,536
35-44	7,481	2,580	4,028	1,868
45-64	5,838	2,694	3,406	1,871
65 and older	2,172	1,966	1,795	1,540
Rural Farm				
Under 25 years old	3,856	674	2,383	581
25-34	6,405	1,775	2,716	1,328
35-44	6.795	2,341	2,186	1,711
45-64	5,024	3,168	2,760	1,944
65 and older	2,395	2,385	1,891	1,732

Source: U. S. Bureau of the Census, ***Census of the Population: 1970. Detailed characteristics.*** **Final Report PC(1)-D26 Mississippi. U.S. Government Printing Office, Washington, D. C.**

formance in the economic system have some utility, it is only by examining more refined measures that program planners gain needed insights.

Median Family Income---There were 534,444 families in Mississippi in 1970 and their median family income was $6,071 in 1969[3], slightly more than twice that of 1959 (Table 1). Also, median family income of Mississippians more than doubled from 1949 to 1959[4]. The median family income of all United States families increased from $5,660 in 1959 to $9,586 in 1969, only about 69 percent.

As is true of all such measures, median family income obscures large variations. Only when the measure is viewed for several different grouping of families does a more detailed picture emerge.

Viewing median income as a measure of quality of life, it is a- parent that Mississippi families e- joying the highest quality of l were white, lived in an urban ar, and were headed by males betwe 35 and 44 years of age (Table Those experiencing the low quality of life were black famil living on a farm and headed by female under 25 years of age.

The highest income for blac was for urban families with m eads between 25 and 34 years of ge.

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[3] U. S. Bureau of the Census, **Census of Population: 1970. General Social and Economic Characteristics.** *Final Report PC(1)-C26 Mississippi. U.S. Government Printing Office, Washington, D. C.*

[4] *Increases in income must be evaluated in light of inflation. For example, although median family income for the state increased by 110.5 percent from 1959 to 1969, real income increased by 58.0 percent, i.e., purchasing power did improve.*

Both black and white females ho headed families were older an male heads irrespective of ace of residence. Female family eads also were different from ales in that their lowest income vel was in the "Under 25" age roup for all three residential asses, whereas the lowest income vel for all male heads was in the 65 and older" group (Table 2.).

Female heads had a lower initial come level than did males (both lack and white) and reached their ighest income level at higher ges. This relationship held for all ree residential classes.

The families with white male eads had significant advantages ver other families, no matter here they lived, given income as a easure of the families' ability to ompete in the market place for oods and services.

The greatest improvement in amily income from 1959 to 1969 vas experienced by black rural arm families, followed by white ural farm families (Table 3.). During this period Mississippi families xperienced an actual increase in urchasing power relative to the ational average.

Urban white families experienced the least improvement, but the ncome from which the different amily types moved cannot be ignored. Rural farm families, both lack and white, were at the bottom f the scale in 1959 and 1969 but the gap between their incomes and hose of urban families was narrower in 1969 than in 1959.

Table 2. Median Family Income Comparisons By Place of Residence, Race and Sex of Household Head and Age of Household Head , Mississippi, 1969.

Place of Residence Race and Sex	High Income		Low Income	
	Income	Age of Head	Income	Age of Head
	$	Years	$	Years
Urban				
White male head	10,000	35-44	3,697	65+
Black male head	5,873	25-34	2,515	65+
White female head	3,691	45-64	1,880	Under 25
Black female head	2,361	45-64	1,487	Under 25
Rural Nonfarm				
White male head	7,481	35-44	2,172	65+
Black male head	4,232	25-34	1,795	65+
White female head	2,694	45-64	1,428	Under 25
Black female head	1,871	45-64	950	Under 25
Rural Farm				
White male head	6,794	35-44	2,395	65+
Black male head	3,286	35-44	1,891	65+
White female head	3,168	45-64	674	Under 25
Black female head	1,944	45-64	581	Under 25

Source: Table 1 of this report.

Table 3. Median Family Income By Race and Place of Residence, Mississippi, 1959 and 1969, with Comparisons.

Race and Place of Residence	1959	1969	Change	Change in Real Income
	$	$	%	%
All families	2,884	6,071	110.5	58.0
White				
Urban	5,493	8,883	61.7	21.4
Rural Nonfarm	3,719	6,696	80.0	35.0
Rural Farm	2610	5890	125.7	69.4
Black				
Urban	2,100	3,865	84.0	38.2
Rural Nonfarm	1,271	2,856	124.7	69.2
Rural Farm	974	2,407	147.1	85.6

***Actual income adjusted for changes in purchasing power.**

Source: U.S. Bureau of the Census. *Census of Population: 1970. General Social and Economic Characteristics,* **Final Report PC(1)-C26 Mississippi. U.S. Government Printing Office, Washington, D.C.**

Family Poverty---Slightly more than one half of all families in Mississippi were classified as poverty families in 1959. In 1969, the figure had dropped to 29 percent. It is probable that the figure for 1969 is more realistic than the one used for 1959, because the index used for 1969 represented a significant improvement over earlier measures.[5]

The rate of family poverty ranged from a low of 11 percent for urban families with a male head between 25 and 44 years of age (black and white combined) to a high of 97 percent for black rural farm families with a female head under 25 years of age (Table 4.).

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[5] *The new index allows for differences in the cost of living between farm and nonfarm families. It also accounts for differences in family size and sex of family head.*

Table 4. Number of Families With Income Less Than Pove Level By Place of Residence, Sex and Age of Family Head*, M sissippi, 1969.

Place of Residence and Sex	Under 25		25-44		45-64		Over
	No.	%	No.	%	No.	%	No.
Urban							
All families							
Male Head	3463	(18)	9293	(11)	9395	(13)	8837
Female Head	1549	(67)	9010	(62)	6329	(46)	3210
Black							
Male Head	1261	(34)	5709	(32)	6265	(36)	4895
Female Head	1194	(81)	6947	(81)	4954	(68)	2299
Rural Nonfarm							
All families							
Male Head	3600	(22)	18674	(22)	22315	(30)	21163
Female Head	1088	(75)	6903	(71)	6530	(59)	4749
Black							
Male Head	1807	(49)	11148	(58)	13222	(61)	9794
Female Head	790	(91)	5018	(86)	4778	(70)	3036
Rural Farm							
All families							
Male Head	438	(38)	3574	(30)	7554	(31)	4994
Female Head	121	(82)	653	(69)	848	(48)	641
Black							
Male Head	352	(73)	2207	(64)	4431	(62)	2607
Female Head	111	(97)	575	(86)	689	(72)	439

***Only 48 of the 124 "thresholds" are used in this table.**

Source: U.S. Bureau of Census, *Census of Population: 1970. Detai Characteristics.* **Final Report PC(1)-D26 Mississippi. U.S. Gover ment Printing Office, Washington, D.C.**

Poverty remains a problem in Mississippi and the fact that more than one-fourth of the families in the state fell below the poverty level in 1969 leaves no doubt that quality of life for the state as a whole is less than is desirable.

Employment Indicators---The total civilian labor force in Mississippi increased from 711,898 in 1960 to 754,836 in 1970. There was considerable variation, however, according to race, sex and place of residence. The black labor force decreased by 42,249, while the white labor force increased from 446,089 to 531,276.

The number of white females in the labor force increased from 143,145 in 1960 to 199,577 in 1970 (Table 5.). White males increased by 28,755 for the same time period--an increase of about 9 percent. Among blacks, the decrease of 16 percent during the decade was accounted for almost wholly by males.

Participation in the labor force in urban areas increased by about 20 percent during the 10 years, but only about one percent of the increase was accounted for by blacks. In 1960, 246,779 members of the labor force were classified as rural nonfarm residents. By 1970 this component of the labor force had increased to slightly more than 306,000 and most of this increase was accounted for by whites.

The number of rural farm residents classified as members of the labor force decreased by almost 50 percent from 1960 to 1970. The largest decrease occurred among black males. The number declined by 70 percent in the decade. White males, with a loss of 42 percent, were followed by white females with a loss of only 12 percent.

Unemployment---Unemployment dropped from 5.4 percent in 1960 to 5.0 percent in 1970. The unemployment rate in 1970 ranged from 2.4 percent for urban white males to 14.9 percent for rural-farm, black females. In 1960, comparable rates were 3.5 and 9.8. For all males the unemployment rate dropped from 4.9 percent in 1960 to 3.8 percent in 1970, but the rate remained essentially the same
females.

Industrial Shifts---Industr
shifts refer to changes in t
number of persons employed in t
major sectors of the econom
Although most of the occupatior
categories showed growth fro
1960 to 1970, agriculture experier
ed a significant decrease, pa
ticularly among nonwhites.[6] No
whites, on the other hand, e

Nonwhites is not synonymous with blacks; included in the nonwhite category are blacks and others, such as American Indians, not classified as whites.

ble 5. Civilian Labor Force (People 16 years of age and older) By Race, Place of Residence and , Mississippi, 1960 and 1970, With Comparisons.

Place of Residence and Race	1960		1970		Change from 1959 to 1969	
	Male	Female	Male	Female	Male	Female
The State						
ite (16 and over)	302,944	143,145	331,699	199,577	+28,755	+56,432
mployed	290,333	136,273	321,884	191,262	+31,551	+154,989
nemployed	12,791	6,872	9,815	8,315	- 2,976	+ 1,443
Unemployed	4.2	4.8	3.0	4.2		
ack (16 and over)	166,972	98,837	125,507	98,053	-41,465	- 784
mployed	156,488	90,619	116,709	87,524	-39,779	- 3,095
nemployed	10,484	8,218	8,798	10,529	- 1,686	+ 2,311
Unemployed	6.3	8.3	7.0	10.7		
Urban						
ites (16 and over)	125,759	72,891	155,807	104,477	+30,048	+31,586
mployed	121,270	69,489	152,058	100,597	+30,788	-31,108
nemployed	4,489	3,402	3,749	3,880	- 740	+ 478
Unemployed	3.5	4.7	2.4	3.7		
acks (16 and over)	55,529	50,556	53,482	53,145	- 2,047	+ 2,589
mployed	50,282	46,568	49,901	48,291	- 381	+ 1,723
nemployed	5,247	3,988	3,581	4,854	1,666	+ 866
Unemployed	9.4	7.8	6.7	9.1		
Rural Non-Farm						
hites (16 and over)	111,610	49,268	137,685	76,690	+26,075	+27,422
mployed	105,461	46,838	132,656	72,926	+27,195	+26,088
nemployed	6,149	2,430	5,029	3,764	- 1,020	+ 1.334
Unemployed	5.5	4.9	3.7	4.9		
acks (16 and over)	55,278	30,623	55,162	36,899	- 116	+ 6,276
mployed	51,685	28,118	51,165	32,429	- 520	+ 4,302
nemployed	3,593	2,505	3,997	4,479	+ 404	+ 1,974
Unemployed	6.5	8.2	7.2	12.1		
Rural Farm						
hites (16 and Over)	65,575	20,986	38,207	18,410	-27,368	- 2,576
mployed	63,422	19,946	37,170	17,739	-26,252	- 2,207
nemployed	2,153	1,040	1,037	671	- 1,116	- 369
Unemployed	3.2	5.0	2.7	3.6		
acks (16 and over)	56,165	17,658	16,863	8,009	-39,302	- 9,649
mployed	54,521	15,933	15,643	6,813	-38,878	- 9,120
nemployed	1,644	1,725	1,220	1,196	- 424	- 529
Unemployed	2.9	9.8	7.2	14.9		

urce: U.S. Bureau of Census, *Census of Population: 1970. General Social and Economic Characteristics.* **nal Report PC (1)-C26 Mississippi; U.S. Bureau of Census.** *Census of Population: 1960. Detailed aracteristics.* **Final Report PC (1)-C26 Mississippi.**

Table 6. Employed Labor Force by Economic Sector, Race and Sex, Mississippi, 1960[1] and 1970[2], with Comparisons

Economic Sector	1960		1970		Change 1960 to 1970	
	Male	Female	Male	Female	Male	Female
	Number				%	
			White			
Agriculture	53,739	3,956	26,437	2,579	-50.8	- 34.8
Construction	32,210	1,008	38,521	2,068	+19.6	+105.2
Manufacturing	63,934	36,443	84,024	51,414	+31.4	+ 41.1
Transportation, Communication, Utilities	21,608	5,335	25,593	7,303	+18.4	+ 36.9
Wholesale Trade	11,251	2,407	15,772	3,998	+40.2	+ 66.1
Retail Trade	44,106	28,449	49,918	36,432	+13.2	+ 28.0
Business and Repair Service	8,147	1,289	9,877	2,650	+21.2	+105.6
Private Household & Other Personal Services	5,640	10,466	5,394	11,341	- 4.3	+ 8.3
Public Administration	15,712	7,011	19,164	7,252	+21.9	3.4
Educational Service	6,938	16,012	12,280	26,226	+77.0	+ 63.8
Health Services	4,403	10,470	4,599	17,360	4.4	+ 65.8
			Non-White			
Agriculture	73,803	14,780	22,986	1,712	-68.8	- 88.4
Construction	11,540	91	12,856	325	+11.4	+257.1
Manufacturing	28.335	2,092	37,762	12,669	+33.3	+505.5
Transportation, Communication, Utilities	7,940	371	8,632	1,334	+ 8.7	+259.6
Wholesale Trade	3,084	260	3,666	510	+18.9	+ 96.1
Retail Trade	13,225	8,149	10,221	8,498	-22.7	+ 4.3
Business and Repair Service	1,943	56	2,060	431	+ 6.0	+669.6
Private Household & Other Personal Services	7,145	50,319	4,674	32,374	-34.6	- 35.7
Public Administration	1,549	301	2,448	948	+58.0	+215.0
Educational Services	3,955	9,092	7,096	19,060	+79.4	+109.6
Health Services	1,334	3,147	1,889	6,982	+41.6	+121.8

[1] **Source: U.S. Bureau of the Census.** *Census of Population: 1970 Detailed Characteristics.* **Final Report PC (1)-D26 Mississippi.**
[2] **Source: U.S. Bureau of the Census.** *U.S. Census of Population: 1960. Detailed Characteristics.* **Mississippi. Final Report PC (1)-26D.**

ıble 7. Educational Levels of Residents 25 Years of Age and Older By Place of Residence, Sex, and ıce*, Mississippi, 1960[1] and 1970[2].

ace of sidence x and Race	Total Population 25 Years Old and Older		Median Years of School Completed		Completed One to Eight Years		Completed High School		With Some College		With Four or more Years of College	
	1960	1970	1960	1970	1960	1970	1960	1970	1960	1970	1960	1970
	Number				%							
ban												
ales												
Vhite	133,387	161,985	12.2	12.5	23.6	17.5	19.8	30.4	14.0	15.9	14.7	19.2
Nonwhite	59,108	61,778	6.2	7.7	69.3	57.2	6.3	11.2	2.2	3.5	2.5	4.8
males												
Vhite	150,313	189,110	12.2	12.4	28.7	14.9	34.5	37.1	14.3	15.8	9.4	11.8
Nonwhite	78,259	84,570	7.2	8.6	63.5	52.3	7.7	12.6	2.5	3.7	3.2	5.5
ral												
n-Farm												
ales												
White	126,028	163,805	9.6	10.8	43.8	34.9	18.4	25.4	7.5	9.0	6.4	6.8
Nonwhite	61,554	71,647	4.5	6.0	76.2	69.8	2.6	5.5	.8	1.5	1.2	1.9
males												
White	132,270	175,978	10.5	11.3	36.2	28.4	24.2	30.4	7.7	8.0	4.8	4.9
Nonwhite	73,939	86,182	6.3	7.7	74.3	63.8	3.4	7.3	1.5	1.8	1.6	3.2
ıral Farm												
ales												
White	69,718	37,690	8.8	10.6	52.5	35.4	14.7	24.6	4.8	8.8	2.8	5.0
Nonwhite	53,236	18,095	4.6	5.5	80.8	76.8	1.8	3.3	.6	1.3	.4	1.3
males												
White	70,243	38,897	9.9	11.4	40.5	26.4	10.6	30.8	6.0	8.4	3.3	5.0
Nonwhite	56,921	19,267	6.4	7.5	77.8	67.8	2.5	6.4	1.3	1.9	1.0	3.0

Vhere person of Spanish language not included.

U.S. Bureau of the Census. *U.S. Census of the Population: 1960. General Social and Economic haracteristics, Mississippi.* **Final Report PC (1)-26C.**

U.S. Bureau of the Census. *Census of the Population: 1970. General Social and Economic Characteristics.* **inal Report PC(1)-C26.**

erienced significant gains in her categories. In educational rvices and in health services nonnite females more than doubled eir numbers. Nonwhite males so increased their numbers in ose two categories (Table 6.)

Education Indicators---ducation contributes to quality of fe in two ways. One of these, the sthetic, is a highly personal atter and the value of education this regard does not lend itself to antification. The other way by hich education contributes to ality of life is seen in the wellocumented relationship between lucation and earning power; i.e., general, the more formal education one has the more money one can earn.

The level of education of Mississippians improved from 1960 to 1970 for both whites and nonwhites, males and females, and for all three residential groups (Table 7.). Urban white males appeared to be the best educated of all groups, with 19.2 percent having completed four or more years of college. Nonwhite residents, although their educational achievements did improve, lagged behind whites as they have historically. Rural residents also continued to lag behind urban residents, but the percent increase between 1960 and 1970 for those with four or more years of college was greater for the rural residents.

Housing Indicators---Housing as a quantifiable dimension of quality of life is evidenced by home ownership, selected plumbing characteristics, number of persons per room, and selected conveniences; i.e., clothes dryer, clothes washer, home freezer and television.

Home Ownership---As measured by the changes in home ownership there was vast improvement from 1960 to 1970 for white and black Mississippians in both urban and rural areas. Although the total number of owned homes decreased for both white and black rural farm

Table 8. Selected Housing Characteristics By Place of Residence and Race, Mississippi, 1960[1] an 1970[2].

Place of Residence and Race	All Occupied Homes						
	Owner Occupied		With Hot and Cold Piped Water	With No Piped Water		With One o More Persons Per Room	
	N	%	%	N	%	N	%
Urban							
White							
1960	100,257	64.5	95.1	1,099	.6	15,547	10.0
1970	141,801	68.0	98.0	1,182	.5	13,648	6.5
Black							
1960	32,913	42.3	42.6	4,038	5.2	26,372	33.9
1970	42,688	48.2	75.4	5,194	5.9	24,310	27.4
Rural Nonfarm							
White							
1960	94,268	68.4	56.6	54,542	29.8	22,442	16.3
1970	149,591	77.5	81.0	28,594	12.3	17,671	9.6
Black							
1960	28,380	38.6	7.8	48,533	65.9	29,883	40.6
1970	44,082	49.9	31.6	50,062	56.7	29,053	34.6
Rural Farm							
White							
1960	54,310	80.7	54.4	19,277	28.6	10,465	15.6
1970	33,849	90.5	88.7	2,368	16.2	3,551	7.4
Black							
1960	17,666	31.6	3.4	47,567	84.7	28,719	51.0
1970	9,495	49.0	25.2	13,020	67.2	8,583	16.0

[1] Sources: U.S. Bureau of the Census. *U.S. Census of Housing: 1960.* Volume I, States and Small Are Mississippi. Final Report HC (1)-26.

[2] U.S. Bureau of the Census. *Census of Housing: 1970 Detailed Housing Characteristics.* Final Report (1)-B26 Mississippi.

residents, the rate or percent of ownership increased (Table 8.).

Owner-occupied housing units represented 66.3 percent of the total number of all occupied dwellings in the state in 1970. For 1960 the figure was 57.7 percent. The largest proportionate increase in ownership was achieved by rural farm blacks. The lowest increase was achieved by urban whites but the percent of ownership in this group in 1960 was twice that of rural farm blacks.

Plumbing Characteristics---One of the most significant improvements in level of living or quality of life is the addition of piped water in the home. For rural, nonfarm whites the increase in number of homes with hot and cold piped water was 81.7 percent. Although there was a decrease from 1960 to 1970 in the number of rural white farm homes with hot and cold piped water, the proportion increased.

The increase in rural nonfarm black homes with hot and cold piped water was more than 380 percent. For rural farm blacks the increase was 154 percent; however, it should be noted that the base from which this percentage was computed was rather small. Still, t proportion of rural homes with piped water was large for blac More than two-thirds of the ru farm homes of blacks had no pip water in 1970.

Persons Per Room---The qual of life for both white and bla owners and renters (as measu by privacy or lack of crowdedne improved from 1960 to 1970 (Ta 8.). Renters were living in m crowded conditions than w owners in both 1960 and 1970. T conditions for blacks were wo than those for whites, at least terms of space and privacy.

Table 9. Home Conveniences, By Place of Residence and Race, Mississippi, 1960[1] and 1970[2].

Residence	Percent of Homes Without			
	Clothes Washer	Clothes Dryer	Home Freezer	Television Set
Urban				
White				
1960	27.4	90.2	76.6	11.4
1970	23.5	52.6	56.2	6.1
Black				
1960	56.9	99.2	73.2	45.4
1970	50.6	95.0	73.2	14.1
Rural Nonfarm				
White				
1960	21.0	95.3	64.6	22.8
1970	13.2	43.7	24.6	3.7
Black				
1960	70.0	99.6	90.9	67.3
1970	54.5	97.4	62.3	19.2
Rural Farm				
White				
1960	13.6	96.5	45.0	25.7
1970	12.8	67.5	18.1	4.9
Black				
1960	65.1	99.9	87.6	69.9
1970	44.6	97.0	47.9	18.0

[1] **U.S. Bureau of the Census.** *U.S. Census of Housing: 1960.* **Volume I, States and Small Areas. Mississippi. Final Report HC (1)-16.**

[2] **U.S. Bureau of the Census.** *Census of Housing: 1970 Detailed Housing Characteristics.* **Final Report HC (1)-B26. Mississippi.**

Conveniences---As with other easures of quality of life, conitions improved for both white nd black residents in both urban nd rural areas (Table 9.). For example, in 1960 about 90 percent of e white urban homes did not ave a clothes dryer, but by 1970 at figure had dropped to 52.6 perent. The addition of these and ther conveniences obviously flects improvements in the quali- of life.

Health Indicators---The ances of infant survival reflect not only the medical services available but also such things as the nutrition of the mother, the child, and the adequacy of conditions in the home. The infant mortality rates for blacks and whites in Mississippi decreased between 1960 and 1970 (Table 10.), and the gap in infant mortality between the two races narrowed considerably.

Hospital Beds, Physicians and Dentists---There was virtually no change in the number of physicians or dentists per 1,000 population (Table 10.). The number of hospital beds per thousand population did increase by about one bed between 1960 and 1970.

Senior Citizens---The number of people 65 years old and over increased from 190,029 in 1960[7] to 222,320 in 1970[8]. Facilities for the aged or infirm and the use of these facilities also increased (Table 11.). The number of *patients served* during each year increased by 228 percent. New admissions were up from 1,741 in 1960 to 7,037 in 1970.

The increase in new admissions

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[7] *U.S. Bureau of the Census.* **General Population Characteristics** *1970 PC (1) 26B. Mississippi.*

[8] *U.S. Bureau of the Census.* **General Population Characteristics** *1970 PC (1) 26B. Mississippi.*

Table 10. Hospital Beds, Physicians, Dentists, and Infant Mortality Rate Per 1,000 Population, Mississippi, 1960 and 1970.

	1960		1970[3]
Hospital Beds	6.85[1]	(1961)	7.81
Physicians	.77	(1961)	.81
Dentists	.28	(1961)	.27
Infant Mortality			
White	26.6[2]		19.1
Black	54.3		39.9

[1] Source: U.S. Bureau of the Census, *Statistical Abstract of the United States: 1963.* U.S. Government Printing Office, Washington, D.C. Figures reported for hospital beds, physicians and dentists are for 1961.

[2] These infant mortality rates represent the number of deaths of infants under one year of age per 1,000 live births and are inclusive of children through the first year of life. These 1960 figures are based on material found in the *Statistical Abstract of the United States: 1964,* U.S. Bureau of the Census, U.S. Government Printing Office, Washington, D.C.

[3] Source for all 1970 statistics: Mississippi Regional Medical Program, *Mississippi Health Resources Profile: 1972,* 880 Lakeland Drive, Jackson, Mississippi.

Table 11. Institutions for the Aged or Infirm, Mississippi, 196 and 1970.

Institutions For General Patients	1960[1]	197
Number (on December 31)	93	11
Bed Count (on December 31) (Number)	2,570	6,24
Number of Patients (on December 31)	1,925	5,1
Patients Served during Year (Number)	3,412	11,1
New Admissions during Year (Number)	1,741	7,0

[1] The 1960 figures are approximations using 1961 data. Sourc Division of Research, College of Business and Industry, *Mississi pi Statistical Abstract: 1973,* Mississippi State University, Mississi pi State, Mississippi.

[2] Division of Research, College of Business and Industr *Mississippi Statistical Abstract: 1973,* Mississippi State Universit Mississippi State, Mississippi.

uld, of course, reflect several ifferent trends, one of which ight be a greater willingness of e aged and infirm to utilize the ervices available. The Medicare nd Medicaid programs probably ad an impact on the increase in e number of patients admitted to stitutions for the aged or infirm.

Welfare Indicators---The umber of participants in the arious public assistance programs changed noticeably: The number receiving old age assistance and aid to the blind decreased while the number receiving aid to dependent children and aid to the permanently and totally disabled increased (Table 12.).

All types of recipients had an increase in average monthly payments. Adjusting these increases for the change in purchasing power of money showed that the increase was real; that the purchasing power of welfare payments (old age assistance excepted) was indeed larger in 1960 that in 1970. Thus, the state (with the aid of Federal programs) not only assumed some responsibility for a larger number of people in need, but also increased its monetary support.

able 12. Public Assistance Payments By Programs, Mississippi, 1960 and 1970.*

ype of xpenditure	1960 Average Monthly Payments	1960 Number of Recipients	1970 Average Monthly Payments	1970 Number of Recipients
ld Age Assistance	34.58	80,260	45.18	73,534
id to Dependent Children	9.36	78,044	13.49	99,951
id to the Blind	38.44	6,244	55.22	2,123
id to Permanently and totally Disabled	34.61	12,509	53.84	21,930
otal for State		177,057		197,538

Sources: The source for the 1960 data is the U.S. Bureau of the Census, *Statistical Abstract of the United States:* **1951, 1956, 1960-1967, (88th Edition) Washington, D.C., 1967.**

he source for the 1970 data is the Mississippi State Department of Public Welfare, *Public Welfare in ississippi Annual Report July 1, 1960 - June 30, 1970.*

Comparison of Selected Indicators For Mississippi, The East South Central States, and The United States

Mississippians experienced more hange in some quality-of-life inicators than did residents of other outhern states and the United tates as a whole (Table 13.).The ost apparent change was the elatively greater increase in median family income. Even with a real income increase of 58 percent, however, the 1969 incomes of Mississippians were still below those of their neighbors.

Unemployment declined in Mississippi over the ten years but not by as much as it did for neighboring states or for the United States. Plumbing facilities improved much less in Mississippi than in the East South Central States and in the United States.

Implications for Action

There are no easy solutions to ocial problems, but action agenies with mandates to engage in acivities that will have significant mpacts on problems must deal with them to the best of their abilities. As part of their input they should utilize as much factual data as they can possibly bring to bear on the problems they attack.

The role of action agency personnel with respect to factual data requires them to perform two related tasks. First, they must be able to identify the types of data relevant to their particular problem. Second, they must be able to determine the meaning of these facts in light of their problem. For example, this report shows that in 1970 about 29 percent of the

Table 13. Comparison of Selected Quality of Life Indicators for Mississippi, The East South Central States*, and the United States.

Indicators		Mississippi	East South Central*	United States
Median Family Income				
	1959	$2884	$3793	$5660
	1969	6071	7166	9586
Real Income	Change	+58.0%	+41.8%	+27.2%
Percent of Families Classified as Poverty Families				
	1959	52.0	40.0	21.0
	1969	29.0	21.0	11.0
	Change	-23.0	-19.0	-10.0
Total Civilian Labor Force				
Male	1960	476,993	2,803,120	45,792,822
	1970	458,199	2,895,231	49,549,239
	Change	-3.9%	+3.3%	+8.2%
Female	1960	244,630	1,334,073	22,351,257
	1970	298,288	1,778,100	30,501,807
	Change	+21.9%	+33.3%	+36.5%
Unemployment				
	1960	5.4%	5.6%	5.1%
	1970	5.0%	4.6%	4.4%
Home Ownership				
	1960	37.7%	61.8%	61.8%
	1970	66.3%	66.7%	62.9%
Percent of Occupied Housing Units Lacking Some or All Plumbing Facilities				
	1960	45.5%	47.0%	26.0%
	1970	22.1%	16.5%	5.5%

* These figures include Mississippi.

Source: U.S. Bureau of the Census, *County and City Data Book*, 1962 (A Statistical Abstract Supplement) U.S. Government Printing Office, Washington, D.C., 1962.

U.S. Bureau of the Census, *County and City Data Book*, 1972 (A Statistical Abstract Supplement) U.S. Government Printing Office, Washington, D.C., 1973.

milies in Mississippi had an in- me below the poverty level, but is fact by itself has little value for tion agencies. If poverty is view- as a social problem, personnel of tion agencies with assignments combat poverty must seek ad- tional facts about poverty- ricken families before they can fectively deal with the problem. aving obtained additional facts, ey must then ask what the facts ean with respect to their agency sources.

The second task, data interpreta- on, is critical. If poverty is viewed the misfortune of the individual, tion agencies will tend to focus programs designed to help overty-stricken people meet cer- in needs; e.g., housing, educa- on, medical care, etc. If, on the her hand, poverty is viewed as e manifestation of a flaw in the stem, action agencies tend to cus on ways to eliminate the flaw y altering the system. The ifference pointed out here is that focus on causes versus focus on mptoms. For the great majority action agencies working at the cal level a focus on symptoms is ppropriate in most instances, but ose agencies must be aware that symptoms focus aims for the lleviation of certain undesirable spects of a particular social roblem and not the solution of the roblem itself.

As a means of assisting action gencies in the identification and terpretation of data, two models re presented here. One is a ymptoms-focused model and the ther is a cause-focused model. oth models use poverty as their roblem base, but the basic rocedure could be adapted to any roblem. Moreover, they can be tilized at different levels; that is, from concrete action programs to abstract theoretical orientations.

The basic procedure involved in the models is simply that of reducing an abstract or complex term to less complex terms. Part of their utility is the fact that they provide a type of blueprint for deductive treatment of complex phenomena in terms of causes and characteristics; i.e., "symptoms". These models, therefore, should be useful in both research and action programs.

A word of caution is in order concerning use of these models, namely, the interrelatedness of causal factors and "symptoms" is not portrayed explicitly. Moreover, the models should not be viewed as complete in the sense that they list all causes and all symptoms. There is no reason, however, why users of the models could not expand them and thereby increase their specificity.

To illustrate the utility of the models, an action agency, viewing family poverty from the causal perspective, might ascertain that the major cause of a lack of adequate family income is the breadwinner's lack of a saleable skill (Figure 1.). On the basis of this information the agency would logically focus its remedial efforts on training programs to upgrade his work skills.

Such programs, however, must be based not only on information pertaining to the poverty-stricken family, but also on knowledge of employment opportunities in various skill areas; e.g., sheet metal work, building trades, etc. It is, in other words, an exercise in futility to train workers for non-existing jobs. Moreover, to assume that upgrading the breadwinner's work skills will have the desired effect of alleviating the "symptoms" of poverty even with a higher paying job is risky. The family's patterns of consumption may be critical; for example, the need and/or desire for plumbing facilities may be very low in the family's scale of priorities but at the same time may be very important in terms of health and sanitation.

Viewing family poverty from the symptoms perspective, another action agency might determine that its most significant impact could be made in relation to housing (Figure 2.). Still another might define its major helping potential as that of promoting and assisting in the development of local organizations to improve conditions through cooperative action.

One characteristic of both models is that they can be read from either the right or left Reading from left to right is a deductive exercise; for example, in the causal model two direct causes of family poverty are listed and the reader is led to a second cause level wherein are listed several sufficient causes of the direct cause. Cause Level II, in other words, lists causes once removed from the problem. A typical statement drawn from the causal model is: family poverty may be caused by inefficient use of resources, which in turn may be caused by lack of knowledge which is a result of inadequate education.

Specific recommendations for action programs are not listed in this report for two reasons. First, the statewide data in the report are not sufficiently detailed to permit the planning of highly focused programs. Second, personnel of action agencies who have both training and experience in problem-solving are more knowledgeable and better equipped to work on problems from the action base.

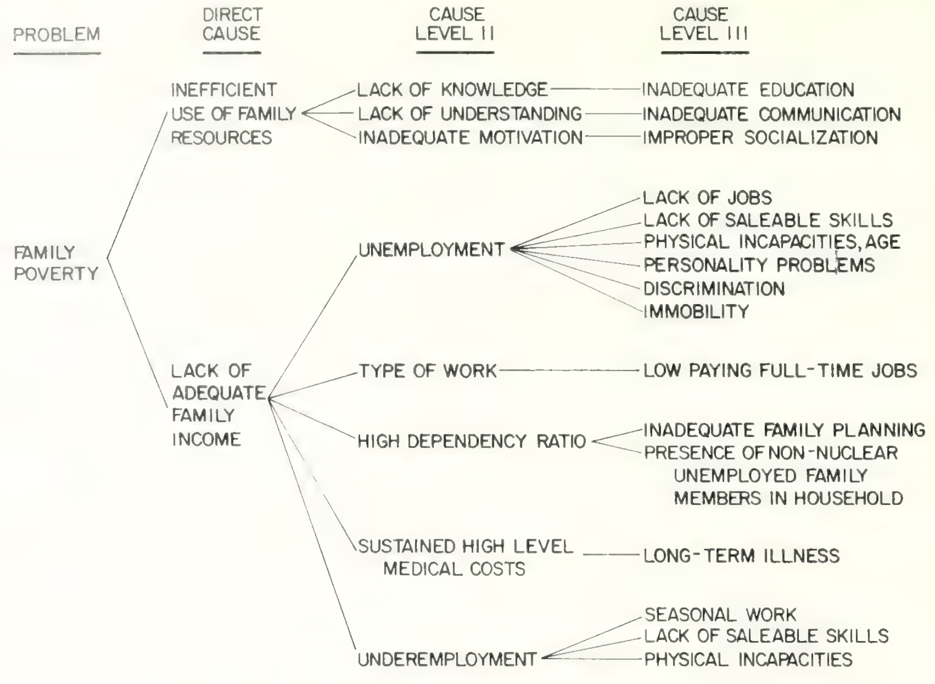
PROBLEM
DIRECT CAUSE
CAUSE LEVEL II
CAUSE LEVEL III
FAMILY POVERTY
INEFFICIENT USE OF FAMILY RESOURCES
LACK OF KNOWLEDGE
INADEQUATE EDUCATION
LACK OF UNDERSTANDING
INADEQUATE COMMUNICATION
INADEQUATE MOTIVATION
IMPROPER SOCIALIZATION
LACK OF ADEQUATE FAMILY INCOME
UNEMPLOYMENT
LACK OF JOBS
LACK OF SALEABLE SKILLS
PHYSICAL INCAPACITIES, AGE
PERSONALITY PROBLEMS
DISCRIMINATION
IMMOBILITY
TYPE OF WORK
LOW PAYING FULL-TIME JOBS
HIGH DEPENDENCY RATIO
INADEQUATE FAMILY PLANNING
PRESENCE OF NON-NUCLEAR UNEMPLOYED FAMILY MEMBERS IN HOUSEHOLD
SUSTAINED HIGH LEVEL MEDICAL COSTS
LONG-TERM ILLNESS
UNDEREMPLOYMENT
SEASONAL WORK
LACK OF SALEABLE SKILLS
PHYSICAL INCAPACITIES

FIGURE 1. A MODEL FOR ANALYSIS OF POVERTY WITH THE FOCUS ON CAUSES.

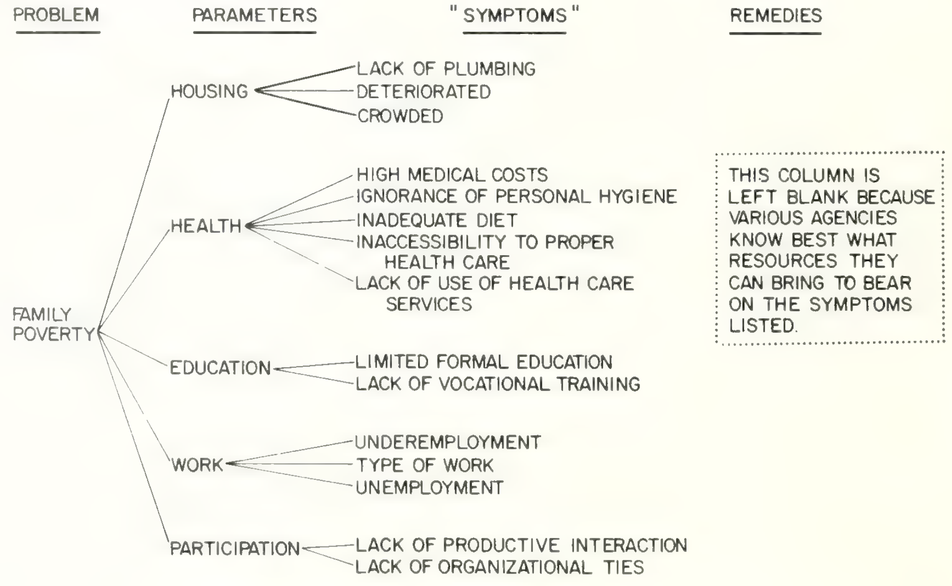
PROBLEM
PARAMETERS
"SYMPTOMS"
REMEDIES
FAMILY POVERTY
HOUSING
LACK OF PLUMBING
DETERIORATED
CROWDED
HEALTH
HIGH MEDICAL COSTS
IGNORANCE OF PERSONAL HYGIENE
INADEQUATE DIET
INACCESSIBILITY TO PROPER HEALTH CARE
LACK OF USE OF HEALTH CARE SERVICES
EDUCATION
LIMITED FORMAL EDUCATION
LACK OF VOCATIONAL TRAINING
WORK
UNDEREMPLOYMENT
TYPE OF WORK
UNEMPLOYMENT
PARTICIPATION
LACK OF PRODUCTIVE INTERACTION
LACK OF ORGANIZATIONAL TIES
THIS COLUMN IS LEFT BLANK BECAUSE VARIOUS AGENCIES KNOW BEST WHAT RESOURCES THEY CAN BRING TO BEAR ON THE SYMPTOMS LISTED.

FIGURE 2. A MODEL FOR ANALYSIS OF POVERTY WITH THE FOCUS ON SYMPTOMS.

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Bulletin 825 January 1975

1975 Crop and Fertilizer Recommendations for Mississippi

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MAFES
MISSISSIPPI AGRICULTURAL & FORESTRY EXPERIMENT STATION
James H. Anderson, Director
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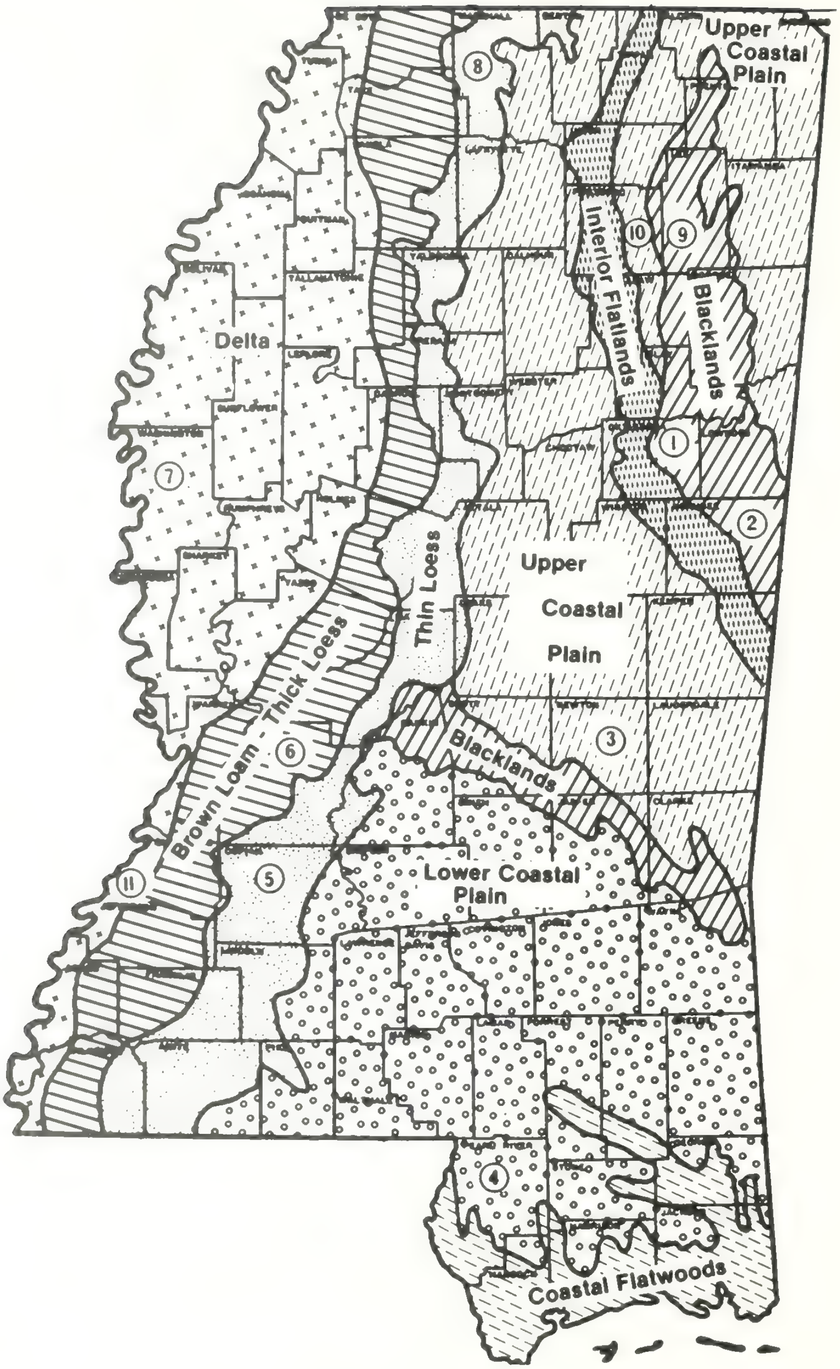
Upper Coastal Plain
8
Interior Flatlands
10
9
Blacklands
Delta
1
7
2
Upper Coastal Plain
Thin Loess
Brown Loam - Thick Loess
6
3
Blacklands
5
11
Lower Coastal Plain
4
Coastal Flatwoods

This map shows land resource areas of the state and how Experiment Station locations fit into them. Number 1 is the headquarters at Miss. State. Branch stations are: 2 Brooksville, 3 Newton, 4 Poplarville, 5 Crystal Springs, 6 Raymond, 7 Stoneville, 8 Holly Springs, 9 Verona, 10 Pontotoc, and 11 Alcorn.

1975 Crop and Fertilizer Recommendations for Mississippi

Crop and fertilizer recommendations are made annually by the Mississippi Agricultural and Forestry Experiment Station. These recommendations incorporate the latest research findings at Mississippi State and the Branch Experiment Stations. Included is information on varieties and fertilization and seeding practices for crops commonly grown in the state, as well as information on lawns and other turf areas.

Because of varying soil and weather conditions and other local factors, no single crop variety or fertilizer recommendation is suitable for all of the state; nonetheless, these general recommendations are useful guides for crop production. Of course these recommendations assume that other good farming practices will be followed.

If more specific information is needed, it may be obtained from the Cooperative Extension Service, the Experiment Station, your County Agent, or other trained agricultural workers in your locality.

Soil Testing Service

You get maximum profit from fertilizer only when you use the right kind and amount on each field. Through the Soil Testing Department of the Cooperative Extension Service every farmer can get this information as well as recommendations for exceptionally high production goals. Also, the Soil Testing Service provides information on liming practices.

Soil testing is a free service. Soil sample boxes, mailing cartons, and instructions for collecting samples are available in each county agent's office and in the offices of other agricultural agencies.

Plant Nutrients

Plant nutrients may be divided into two group---(1) those elements used by crops in relatively large amounts, the *macronutrients;* and (2) those needed in very small amounts, the *micronutrients.*

The first group includes nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur. These are usually subdivided into the primary fertilizer nutrients---nitrogen phosphorus, and potassium---and the secondary fertilizer nutrients;---calcium, magnesium, and sulfur. The primary nutrients are applied to crops either as individual materials or as mixed fertilizers.

A fertilizer material usually contains only one fertilizer nutrient. Some examples are as follows: Ammonium nitrate (34% N), anhydrous ammonia (82% N), urea (45% N), concentrated superphosphate (45% P_2O_5), and muriate of potash (60% K_2O).

Mixed fertilizers contain two or more of the fertilizer nutrients. Each fertilizer bag is labeled with a set of numbers to show how much of each nutrient it contains. The first number shows the percentage of nitrogen (N); the second, the percentage of available phosphate (P_2O_5); and the third, the percentage of available (water-soluble) potash (K_2O). One hundred pounds of a 10-20-20 fertilizer thus contains 10 pounds of total N, 20 lbs. of available P_2O_5, and 20 lbs. of available K_2O.

Fertilizer ratio refers to the relative amounts of these nutrients. The fertilizer grade gives the guaranteed amounts of each fertilizer nutrient as a percentage. For example 8-8-8 and 10-10-10 are two different grades in a 1-1-1 ratio. Similarly 6-18-18 and 8-24-24 are two grades in a 1-3-3 ratio. Materials such as ordinary superphosphate may be labeled as 0-20-0.

Presently, fertilizer nutrients are either expressed as the oxide---phosphorus as P_2O_5---or as the element---nitrogen as N---but there is a trend toward expressing all fertilizer nutrients on the elemental basis. Accordingly, phosphate would be expressed as (P) and potash as (K) by using the chemical symbols for phosphorus and potassium, respectively. The primary "fertilizer nutrients" expressed on the elemental basis would then be shown as N-P-K on the fertilizer bag.

Some fertilizers are labeled both ways to familiarize consumers with the new labeling trend. When labeled on an elemental basis a 10-20-20 (N-P_2O_5-K_2O) would become a 10-8.2-16.5 (N-P-K). The conversion factors for potash are: $K_2O \times 0.83 = K$; $K \times 1.21 = K_2O$. The conversion factors for phosphate are:

P_2O_5 x 0.436 = P; P x 2.29 = P_2O_5. Only the method of labeling is changed, not the plant nutrient value of the fertilizer.

Fertilizer recommendations are given in this bulletin as pounds of N, P_2O_5 and K_2O needed per acre. Usually the farmer will have a choice of more than one fertilizer grade. For example, 48 lbs. each of N, P_2O_5 and K_2O may be supplied with 600 lbs. of 8-8-8 or 400 lbs. of 12-12-12. Since some deviation from the general recommendation does not affect net profit greatly, it is not necessary to apply exactly the amount of N, P_2O_5 or K_2O indicated.

Both the need for and the presence of the secondary nutrients in fertilizers vary. Research has shown that sulfur deficiency is likely to occur on soils in the Hill section when sulfur-free fertilizers are used. Accordingly, sulfur is recommended for crop production in this area, especially for cotton and legumes. A convenient and economical way to get the sulfur is to use mixed fertilizers that contain sulfur. Most solid mixed fertilizers sold in Mississippi contain adequate sulfur, but most liquid mixed fertilizers do not, unless special provision is made for adding it.

Scattered instances of sulfur deficiencies have been observed in the Delta. These deficiencies have been associated with land leveling on very sandy soils that are low in organic matter. Since mixed fertilizers are less commonly used in this area, other sources of sulfur may be more economical or convenient to apply.

Sources of sulfur that may be used include gypsum, elemental sulfur, ammonium sulfate, and ordinary superphosphate.

Calcium and magnesium are usually applied to soils as agricultural limestone.* On soils needing magnesium but not requiring lime, the addition of a water-soluble source of magnesium to mixed fertilizers is a very convenient method of supplying the magnesium.

The second group of nutrients is referred to variously as *trace elements, minor elements,* and *micronutrients.* They are needed by crops in very small amounts. Included are iron, manganese, zinc, copper, boron, molybdenum and chlorine. Thus far, only three (zinc, boron, and molybdenum) of these have been found to be appreciably deficient for crop production in Mississippi. These deficiencies have not occurred on all crops and have been restricted mostly to the Hill area.

Solid or Liquid Fertilizers

When used properly, solid and liquid mixed fertilizers are equally effective for crop production in most instances. Therefore, the choice as to which to use should be based primarily upon such factors as comparative costs, ease and uniformity of application, availability of application equipment and labor requirements rather than on differences in agronomic value.

Solid complete fertilizers that contain highly-ammoniated ordinary superphosphate (20% P_2O_5) are less effective than other complete fertilizers (both liquid and solid). Ammoniation of ordinary superphosphate converts some of the highly-effective water-soluble monocalcium phosphate to a much less effective water-insoluble apatite-like calcium phosphate, the quantity of which increases progressively with increasing ammoniation.**

In general, farmers are assured of good results from mixed fertilizer if 40 percent of the available phosphorus is water-soluble. Some manufacturers show the water-soluble phosphorus content of their fertilizers, though this is not required by law.

A substantial amount of nitrogen in liquid mixed fertilizers usually is derived from urea and-or ammonium nitrate. Nitrogen solutions containing either urea or urea and ammonium nitrate have been proven much less effective for surface application to permanent summer pastures than have either solid urea or ammonium nitrate. Therefore, solid complete fertilizers can be expected to be more effective for summer pastures than would liquid fertilizers containing urea.

Soil pH and Liming

Excessive soil acidity results in reduced crop yields. A recent summary of soil test results by the Cooperative Extension Soil Testing Department showed that 70 percent of the soils tested needed lime for legumes and 40 percent for non-legumes.

The degree of acidity or alkalinity of a soil is expressed by its pH; values below 7.0 indicate an acid soil, values above 7.0, an alkaline soil. Soil reaction, or pH, affects the availability of some of the more important plant nutrients in the soil.

Phosphorus and molybdenum, particularly molybdenum, are much less available to plants in

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The major objective of liming is to neutralize soil acidity.

***Ammoniation of superphosphate to add nitrogen in the formulation and mixed fertilizers is a common practice. The production of ordinary superphosphate is declining rapidly. If the trend continues, its use in mixed fertilizers will be discontinued in the near future.*

very acid soils than in slightly acid to mildly alkaline soils. On the other hand, in strongly and very strongly acid soils (pH below 5.5), certain elements such as manganese and aluminum may become so available as to be toxic to plants.

Micronutrients such as iron, manganese, boron and zinc rapidly become less available as the pH of the soil is increased above 6.0. This is one reason why soils should not be overlimed.

Experience in Mississippi has shown that plant injury from deficiencies of boron and zinc is very likely to be associated with overliming. In the case of cotton and legumes, plant injury is very likely to be due to boron deficiency and with corn, and perhaps other grasses, to zinc deficiency.

Soils with a pH of 6.0 to 7.0 are well supplied with lime. If the pH is less than 5.5, the soil is strongly acid and needs liming. Most non-legumes grow best at soil pH values above 5.5 while most legumes do best if the pH is maintained above 6.0. Alfalfa does best at soil pH values above 6.5.

The amount of lime required to raise the pH of the soil to a desired value depends both on the initial pH and the lime-holding capacity of the soil. For soils of Mississippi having a pH of 5.5 or slightly below, the application of 3000 pounds of lime per acre to sandy loam soil, 5000 or 6000 pounds to loam and silt loam soil, and 7000 to 000 pounds to clay loam and clay soils, respectively, has satisfactorily corrected lime deficiency for legumes. Since about two-thirds of the soils of the state have pH values of 5.5 or above (with 95 percent above 5.0) these rates of lime would bring the pH of most of the soils of the state within the range that is favorable for legumes. However, some soils need more, some less, and some none. *Therefore, the best practice is to test the soils for pH and lime requirement and apply lime as needed to maintain the pH within the desired range.*

Lime is lost naturally from the soil by crop removal and by leaching. The use of acid-forming sources of nitrogen and the turning under of legumes as soil builders accelerate leaching losses. For example, 100 pounds of nitrogen from such sources as ammonium nitrate, anhydrous ammonia and urea will cause the loss of calcium and other bases equal to about 200 pounds of lime. When applied annually at this rate, the loss would amount to one ton of lime every ten years due to fertilizer alone. Because of these losses, soils need to be limed periodically.

Generally, on sandy loam, loam and silt loam soils, a maintenance application of 2000 to 3000 pounds of lime per acre once every five to seven years is required for legumes and for non-legumes fertilized with nitrogen as recommended. On clay loam and clay soils, less frequent but larger applications are required. Except for the dark upland soils and the bottom soils of the Northeast Blackland area, maintenance application should be made to soils that have not been limed during the past five to seven years.

Although lime may be needed badly for non-legumes on some soils, the deficiency is not widespread enough to warrant a general recommendation for rates in excess of maintenance requirements. *When there is doubt have the soil tested.*

Areas going into permanent grass sod should receive the initial maintenance application of lime before sod is established. Subsequent maintenance applications may be broadcast on the established sod.

The principal liming materials available in Mississippi are ground calcic and dolomitic limestones, crushed chalk or marl from Mississippi deposits, and basic slag. Calcic limestones contain calcium carbonate while dolomitic limestones contain both calcium and magnesium carbonates. Liming materials from Mississippi deposits contain only calcium carbonate. Basic slag, a material containing a minimum of six percent P_2O_5 and the equivalent of about 60 percent lime, should be used only where both the lime and phosphate are needed. The cost of its use as a liming material only is prohibitive.

Research has shown that all of these materials are very effective in neutralizing soil acidity, providing the calcic and dolomitic limestones are finely ground. Particles not passing a 40-mesh (40 holes per linear inch) screen are not very effective in neutralizing soil acidity. For this reason, 90 to 100 percent of calcic and dolomitic limestones should pass a 10-mesh screen and 50 percent a 100-mesh screen. Particle size is not as important in the case of chalk because it contains clay impurity which causes the particles to break down within the soil. It must be crushed finely enough, however, to be spread uniformly.

Generally, the Delta and Loess soils are abundantly supplied with magnesium; therefore, dolomitic lime is of no advantage in these areas. In other soils of the state, however, magnesium levels tend to be lower and a liming material containing considerable magnesium, such as dolomitic lime, should be used, particularly in the Northeast Blacklands.

For best results lime should be mixed thoroughly with the top six to eight inches of the soil. However, depending on the texture of the soil, maintenance treatments of 1000 to 2000 pounds per acre may be made as a surface application to permanent pastures, or other permanent sods.

The primary benefits of liming acid soils are: (1) increased availability of phosphorus and molybdenum; (2) correction and/or prevention of aluminum and manganese toxicity; (3) reduced loss of potash by leaching, especially on sandy loam and silt loam soils; and (4) increased supply of available calcium, and magnesium where dolomitic lime is used.

To be used most profitably lime should be applied before there are economic reductions in yield due to acid-soil infertility. Though soil productivity may be restored by liming, losses in yield due to acid-soil infertility can never be recovered.

When to Fertilize

The availability of fertilizers to plants decreases with the passage of time following application. This occurs because they may be lost by leaching and volatilization or be converted to less available forms within the soil. Nitrogen is both leached and volatilized. Potassium is leached from some soils but phosphate is not. But phosphate is changed to less available forms.

Fertilizers may contain nitrate or ammonium nitrogen, or both, or other forms (urea) that are changed rather rapidly to ammonium when applied to the soil. Nitrate salts found in fertilizers and in soils are highly soluble in water and are not retained chemically by the soil. Since they remain in solution and move freely with the soil water, they are easily leached from the root zone, particularly on sandy loams, loam and silt loam soils, or other soils where water percolates readily. Under water-logged conditions, which are more likely in clay soils, nitrates may be changed by soil bacteria to gaseous nitrogen (denitrified) which escapes into the atmosphere. Ammonium nitrogen is not denitrified nor is it easily leached, but it does not persist for long periods. It is changed (nitrified) by soil bacteria to nitrate.

Since nitrogenous fertilizers are not held in soils for long periods, they are used more efficiently for crop production when applied at or near planting time or during the growing season. In most instances, applying all of the nitrogen to row crops at or just before planting is just as effective as applying from one-half to all of it as a sidedressing. Exceptions are on deep excessively drained sandy loam soils, or clay loam and clay soils that become water-logged, either because of poor surface drainage or by stream flooding, or both.

Split applications of nitrogen are recommended for grass forages to increase the efficiency of utilization and distribution of forage production, to avoid nitrate poisoning, and to increase nitrogen efficiency by reducing leaching and denitrification losses.

Phosphate fertilizers are not lost by leaching because they react with certain soil constituents to become only sparingly soluble in water. In acid soils the reaction is mostly with iron and aluminum but in neutral and alkaline soils calcium phosphates of very low water solubility also are formed. The soil-phosphate reaction products become less available with time and the process is more rapid in acid soils, particularly at pH values below 6.0.

The formation of sparingly soluble phosphates and their subsequent reduction in availability to plants is referred to as "phosphate fixation." Because of fixation, greater efficiency generally is obtained from annual, seasonal applications of phosphate fertilizer than from less frequent or off-season applications, especially on moderately to strongly acid soils. Accordingly, it is usually suggested that phosphate fertilizers be applied at or just before planting, or near the beginning of the growing period for perennial crops.

Unlike phosphate, the effectiveness of potash fertilizers is not reduced greatly by fixation in Mississippi soils. But there is some loss by leaching, particularly from the more sandy soils. Where leaching is significant, annual or seasonal applications result in more efficient utilization of potash than do less frequent or off-season applications. Because of uptake of potash in excess of need and its removal in the harvested crop, annual and sometimes split applications are necessary for optimum efficiency for hay crops.

Farmers are becoming increasingly interested in further mechanization, in more use o custom services, and in spreading their work-load to increase efficiency. One way of spreading the work-load is to combine fertilizer application with fall land preparation fo spring-seeded crops, where this is feasible.

Fall application of nitrogen fo spring-seeded crops is not practical in Mississippi. However, the level of phosphate and potash in most o the better crop land are such that recommended rates may be applied in the fall with little if any reduction in yield, except on very deep sandy soils where excessive leaching of potash may occur. Potash losses by leaching may b reduced by broadcasting the fertilizer and by liming acid soils t keep the pH above 6.0. Als leaching losses may be compensated by higher rates of application, which may be an acceptab alternative to spring application some cases.

How to Fertilize

Attaining maximum utilization of fertilizers requires that the two components of availability (chemical and positional), be optimized concurrently. Chemical availability refers to the capacity of the fertilizer and its soil-reactio products to supply nutrients plants. Positional availabili efers to the location of the fertilizer ith respect to the plant roots. For xample, fertilizer placed in the soil foot or so from the row is ositionally unavailable to seed- ng plants.

The chemical availability of itrogen and potassium in fer- lizers usually is not affected reatly by degree of contact with he soil. However, the effectiveness highly reactive phosphates is rotected by reducing their contact ith the soil. This slows the rate of hosphate fixation and may be one either by band placement in e soil or by granulation of the fer- izer at the factory. Since most lid fertilizers sold in Mississippi e granulated or pelleted, method application has a greater effect n positional than on chemical vailability in the soil.

To assure effective positional vailability, fertilizers should be laced so that they are moved to lant roots with the soil water or so at the fertilized zone is intercepted by plant roots at the ap- opriate time. As plants grow and tend their roots both horizontal- and vertically, the volume of soil om which nutrients may be ab- rbed is increased. Consequently, rtilizers that are positionally un- ailable during early plant owth may be available later.

Phosphate does not move ap- eciably in soils and the move- ent of potash is somewhat nited, especially on soils of edium to fine texture. Therefore, ese fertilizers must be placed so at the fertilized zone is in- cepted by plant roots. For drill- eded and row crops, phosphate d potash should be placed deeply ough to be in the moist soil where nts feed as they grow. For such ops, surface application or allow incorporation, such as by king, would be expected to give erior results because of poor sitional availability.

Nitrogen as nitrate moves with soil water to plant roots. Its over-all efficiency is not affected greatly by degree of concentration or its location within the root zone in soils of medium to coarse texture, but enough nitrogen should be positionally available for good growth of young plants. However, on clay loam and clay soils, band application in the soil at the edge of the root zone may be superior to broadcast application for row crops, because of increased positional availability and reduced risk of loss of nitrogen by denitrification.

Nitrogenous fertilizers applied to the surface of dry soils are positionally unavailable until dissolved and moved down into plants' root zone by percolating water. Before ammonium nitrogen in fertilizers is moved down into the root zone, it must be changed (nitrified) by soil bacteria to nitrate, a process requiring two or four weeks for completion in moist soil during warm seasons. Poor positional availability is avoided by applying nitrogenous fertilizers far enough in advance for the necessary transformation and movement into the root zone by moisture migration to occur by the time the nitrogen is needed by the crop.

Optimum efficiency of immobile fertilizer nutrients such as phosphorus and potassium results from localized concentration of materials near the row or drill, such as results from band application. This provides a very favorable opportunity for early interception by plant roots and for extensive root development within the fertilizer zone. An outstanding benefit from phosphorus is its favorable influence on the early growth and development of plants, which is enhanced by localized placement of fertilizer near the row.

Although maximum efficiency of phosphate and potash is usually obtained by band placement for row crops and drill-seeded crops, top yields can be obtained with broadcast application of these fertilizers. But on soils that are low to very low in phosphate and potash, attaining the same increase in yield requires higher rates for broadcast than for band application. This is especially true where the fertilizer is incorporated by shallow disking instead of being plowed under. Because of accumulation from previous application or because of high native fertility, only a small percentage of the land previously cropped to cotton and fertilized as recommended over a long period would be expected to require appreciably higher broadcast rates of phosphorus and potash.

Poor stands and stunted growth may result from localized placement of fertilizers too near the row because of salt injury to seeds and seedlings. Since fertilizer salts, such as nitrates and chlorides, move mostly upward and downward with soil water rather than laterally by diffusion, salt injury can be avoided by placing the fertilizer to the side of rather than beneath the seed. The distance of separation required depends upon the kind of fertilizer and the rate of application. For recommended rates of phosphate and potash and up to about 40 pounds of nitrogen per acre, the minimum distance of separation should be three to four inches to one side and three to four inches deeper than the seed. With higher rates of nitrogen or potash, both the horizontal and vertical distances between seed and fertilizer should be increased or the fertilizer should be broadcast and plowed under.

Surface application of phosphate and potash to sod crops is more effective than for row crops. This is due in part to the development and persistence of plant roots near the surface. Because it is both convenient and effective, this method of application is recommended for maintenance fertilizers on perennial, close-growing crops.

Solid sources of nitrogen are much more effective for surface application to summer pastures than are the urea-ammonium nitrogen solutions such as N-Sol-32 and URAN. These solutions have ranged in effectiveness from 66 to 74 percent of that of solid ammonium nitrate. Urea solid has been equal to ammonium nitrate when applied in June, but when applied a month earlier its relative value was about 85 percent of that of ammonium nitrate.

Surface application of solid urea should not be made to pastures or other areas in sod in the spring an summer when the soil is too wet t till or when the grass is wet. applied when either the soil grass is wet excessive atmospher loss of nitrogen as ammonia is lik ly to occur.

Foliar Feeding

Plants absorb and utilize nutrients applied in solution to their leaves and, if a deficiency exists, yield and-or quality may be improved by foliar application. Because they are required in such small amounts, very dilute salt solutions of the *micronutrients* (trace elements) may be used quite satisfactorily as foliar sprays to correct deficiencies without injury (burning) to foliage.

In some areas foliar feeding of trace elements has become a somewhat standard practice in crop production. Frequently, *micronutrients* are applied conveniently and inexpensively along with insecticides and fungicides. A typical example is the application of boron to cotton with the insecticide. So far, under Mississippi conditions, there appears to be no need for both foliar and soil application of micronutrients where they are needed for crop production.

The primary (nitrogen, phosphorus, and potassium) and the secondary (sulfur, calcium, and magnesium) nutrients, are absorbed in relatively large quantities by crops. Thus, to supply a substantial part of the total requirement of these nutrients without burning the leaves of plants would require sever applications of rather dilu solutions during the growi season. Therefore, foliar feeding these nutrients is not as feasible is foliar feeding of th *micronutrients.*

Increases in the yield of cott have been obtained by foli feeding of the primary nutrien under certain conditions, but it h not been shown so far to be desirable or economical alternati to soil application of the nutrients. Therefore, foliar feedi is not now recommended routine in lieu of or as supplement to s application of *macronutrients.*

RECOMMENDATIONS FOR MAJOR FIELD CROPS

Corn

Hybrid: Detailed results of hybrid corn trials are published annually in MAFES Research Highlights.

Seeding Dates and Rates and Land Selection: Plant in North Mississippi from April 1 to April 25, in North Central Mississippi from March 25 to April 20, in South Central Mississippi from February 25 to March 15.

Corn should be planted on deep to moderately deep soil with fair to good surface drainage. Steep, droughty, and eroded hillsides are not suitable for corn.

Stands should be adjusted to yield and generally should be within the range of 12,000 to 18,000 plants for average yields of 80 to 120 bushels per acre. A good rule of thumb is to provide approximately 150 plants for each bushel of corn expected. Thus, on land that will produce an average yield of 80 bushels, the stand should be 12,000 plants per acre, for 100 bushels 15,000 plants, and for 120 bushels 18,000 plants. On land well adapted to corn, yields usually will fall within the range of 80 to 120 bushels per acre under good cultural practices. *However, average yield goals in excess of 100 bushels per acre generally should not be set unless supplemental irrigation is available.*

Fertilization — Hills: Soils of the Hills areas generally require a complete fertilizer for corn. Soils should be limed to maintain the pH above 5.5. Occasionally, following the application of lime, zinc deficiency may occur, especially on soils of medium to coarse texture. Therefore, a mixed fertilizer which contains enough zinc to give pounds per acre should be used two or three years after liming, p ticularly on sandy loam and loam soils. No other micronutri deficiencies have been observe corn.

Time: Apply all of the phosph and potash before planti Nitrogen may be applied bef planting or in split applications split, one-fourth to one-third bef planting and the remainder a side dressing by the time the cor knee high.

Rate: Rate of fertilization sho be adjusted to expected yield. expected yields of 120, 100, and bushels per acre, the respective P_2O_5-K_2O rates should be 160 60, 130-50-50, and 100-40-40 pou per acre. When corn is grown silage the respective N-P_2O_5-

ates should be 130-50-100 for ields of 16 to 18 tons per acre.

Method: All of the phosphate nd potash and up to 40 pounds of itrogen per acre may be placed in band located three to four inches) one side and three to four inches eeper than the seed; the remainıg nitrogen may be drilled six or ıore inches from the row, broadast, or applied later as a sideressing. All or part of the nitrogen ıay be broadcast as a mixture with hosphate and potash; however, ıe fertilizer should be plowed own as should all broadcast pplications of phosphate and otash. Preplant applications of nhydrous ammonia should be laced at least six inches to one side nd five to six inches deeper than ıe seed.

Place side-dress applications of nitrogen a foot or more from the row, non-pressure solutions and solid sources at a depth of four inches and anhydrous ammonia at a depth of six inches. Surface side-dress application of solid sources and non-pressure solutions is almost as effective as in-soil placement.

Fertilization — Delta: For soils in this area, generally only nitrogen is needed for top production. Soil test for phosphate and potash needs.

Time: Nitrogen may be applied just before planting or in split application: if split, use one-third to one-half at or before planting and the rest as a side-dressing before the corn is knee high.

Rate: 100 to 160 pounds of nitrogen per acre, increasing the rate as the expected yield increases from 80 to 120 bushels per acre.

Method: Place preplant applications of nitrogen six or more inches from the drill row, non-pressure solutions and solid sources at a depth of four or more inches and anhydrous ammonia at a depth of five or six inches below the level of the seed. Sidedress applications of nitrogen should be placed one foot or more from the row, non-pressure solutions and solids at a depth of four inches and anhydrous ammonia at a depth of six inches. Surface application of solid sources and non-pressure solutions is only slightly less effective than in-soil placement.

Cotton in the Delta

Varieties: Results of variety sts are published annually in AFES Research Highlights.

Seeding Dates and Rates: ant flat at a depth of two inches soon after April 1 as weather perits, but not until the soil mperature is 68°F: hill dropped--- to 22 pounds delinted seed per re; drilled---30 to 40 pounds of linted seed per acre; drilled for oss plowing---60 pounds of linted seed per acre. Seed should of good viability.

Fertilization: Many Delta soils ed only nitrogen for most ofitable yields but deficiencies of tash and phosphate do occur, escially of potash. For example it is timated that 20 percent of the ndy loam soils, 75 percent of the orly-to somewhat poorly-drained t loam soils and 30 percent of the ty clay loam soils will respond ofitably to potash. Thirty percent the sandy loam and silt loam ils may need phosphate. ıerefore, soils should be tested for osphate and potash needs, as ll as for lime. Also, sandy soils at are low in organic matter, or that have been leveled, should be tested for sulfur needs.

Time: Apply nitrogen in the spring at or before planting, except on sandy loam soils having very good to excessive internal drainage and on clay soils with poor surface drainage. On such soils, make split application of nitrogen, one-third to one-half at or before planting and the rest as a side dressing, preferably by mid-June. Split application of nitrogen on clays with poor surface drainage is recommended because of possible loss of nitrogen by denitrification during wet periods.

Rate: On sandy loam, loam, and silt loam soils use 90 to 100 pounds of nitrogen per planted acre. Use one hundred to 120 pounds of nitrogen per acre on the silty clay loams, silty clays, and clays for all planting patterns, except that for clays with poor surface drainage use 120 to 150 pounds. In a 4x4 or 2x2 planting pattern it is obvious that only one-half of the land area is planted.

For cotton following soybeans or pasture sod, the nitrogen rate should be reduced 20 to 30 and 40 to 50 pounds per acre, respectively.

On soils where stalk growth is too rank, maturity too late, and boll rot is a problem because of excess nitrogen, the nitrogen rate should be reduced by 30 percent.

Sixty pounds of potash banded and 80 pounds broadcast are suggested for the poorly to somewhat poorly drained silt loam and silty clay loam soils (Forestdale and similar types). Phosphate is not recommended but, if applied with potash, use a mixed fertilizer having a P_2O_5-K_2O ratio of 1:3. Neither potash nor phosphate is recommended on other soils except when indicated by a soil test.

Method: Application practices for nitrogen are the same as for corn in the Delta area. Side-dress applications of nitrogen made after mid-June should be placed in the soil. Banded phosphate and potash should be placed three to four inches to one side and three to four inches deeper than the seed. Broadcast phosphate and potash should be worked into the soil by double disking with a breaking disk, or plowed in with a moldbroad plow.

Cotton in Hill Areas

Varieties: Results of variety tests are published annually in MAFES Research Highlights.

Seeding Dates and Rates: Plant between April 10 and May 10 as weather permits: hill dropped---use 16 to 22 pounds of machine delinted seed or 12 to 16 pounds of acid delinted seed per acre; drilled---use 20 to 30 pounds of machine delinted or 15 to 20 pounds of acid delinted seed per acre. Seed should be of good quality.

Fertilization: A complete fertilizer (NPK) containing sulfur and boron is needed in the Hill area. The fertilizer should supply 4 to 8 pounds of sulfur and 0.3 to 0.5 pounds of boron per acre. No more than 0.5 pounds of boron should be applied if the fertilizer is banded or drilled beside the row. Fertilizers for the dark upland soils of the Northeast Blackland area, having a pH above 6.0, should contain enough water-soluble magnesium to supply at least one-half and preferably as much magesia (MgO) as potash. On soils more acid than pH 6.0, magnesium deficiency may be corrected by applying dolomitic lime at the rate of one to two tons per acre, or as indicated by a soil test.

Acid soils should be limed according to soil tests to maintain the pH above 5.5.

Time: Apply the phosphate and potash and all or part of the nitrogen at or a few weeks before planting time. On deep sandy or sandy loam soils with very good to excessive internal drainage, side-dress one-half to two-thirds of the nitrogen for most effective results. Make side-dress applications of nitrogen by mid-June (a week or more earlier if anhydrous ammonia is used or where you surface apply solid sources and non-pressure solutions) or at early square formation.

On most soils, phosphate and potash may also be applied in the fall---see section on When to Fertilize, page 4.

Rate: A recent soil test summary shows that about 35 percent of the soils tested for cotton in the Hill area were high in phosphate and potash. An economic response of cotton to phosphate and potash is unlikely on high-testing soils and, on such soils, only maintenance fertilization is justified. An annual application of 25 to 30 pounds of phosphate and potash is usually adequate for maintenance with current yields. *Accordingly, farmers now applying rates higher than these to high-testing soils have an opportunity to reduce fertilizer costs through soil testing.*

Without a soil test, the nitrogen (N) - phosphate (P_2O_5) - potash (K_2O) rate should be either 72-40-60 or 72-48-48 pounds per acre except as follows: Increase the nitrogen t
120 pounds on the dark uplan
soils of the Blackland areas and t
80 or 90 pounds per acre on the wel
drained botton and the level t
gently sloping upland soils of th
Upper Coastal Plain and on th
bottom soils of the Blacklan
areas.

Excessive stalk growth ar
delayed maturity indicate to
much nitrogen. Somewhat stunte
growth associated with yellowis
green foliage and the early yello
ing and premature shedding of th
leaves indicates too little nitroge
When these conditions are obser
ed nitrogen rates should be a
justed accordingly.

Where a skip-row plantin
pattern is used, the rate of nitrog
per planted acre should be the sar
as for solid-planted cotton. In a 4
4 or a 2 x 2 planting pattern, it is c
vious that only one-half of the lar
area is planted to cotton. Do not f
tilize the unplanted area.

Method: Same as for corn in t
Hill area. Contact placement
seed and fertilizer or placeme
directly beneath seed should
avoided. Side-dress applications
nitrogen made after mid-Ju
should be placed in the soil.

If a preemergence herbicide is
be broadcast and worked into t
soil, phosphate and potash appli
broadcast should be plowed do
before the herbicide is applied.

Soybeans

Varieties: For all areas north of U.S. Highway 84, use Hill, Mack, Forrest, Tracy, Davis, Lee 68, Pickett 71, Semmes, and Bragg (listed in order of maturity).

South of U.S. Highway 84, use Bragg, Hutton, Coker 266A, Coker 338, Cobb, and Hardee.

Soils: Soybeans are adapted to all Delta soils and to most soils of the Hill area, but lower yields may be expected on droughty soils, such as eroded and shallow upland soils.

Seeding Dates and Rates: May 1 to June 15 except extreme South Mississippi, May 20 to June 20. Plant 40 to 50 pounds of good seed per acre.

Inoculation: If not planted on land where a crop of well-nodulated soybeans has grown within the last five years, the seed should be inoculated. To be effective seed must be moistened slightly before applying inoculum, or else the inoculum should be applied as a slur
Applying inoculum dry into
planter box is very ineffective.

Because of injury to the bacte
culture, the inoculant and sodi
molybdate or other soluble mol
date salts should not be premi
for more than 24 hours before be
applied to beans that are plan
immediately following treatme
The safest procedure is to apply
inoculant and molybdate
separately and then stir the b

thoroughly to assure treatment of all beans.

Fertilization—Delta: Soybeans do not require either phosphate or potash on most Delta soils, but many soils need liming. The need for lime as well as phosphate and potash can be determined by a soil test.

Molybdenum usually is needed on sandy loam, silt loam, and clay loam soils having a pH below 6.0. The need for molybdenum is not as great on the clay soils; however, yields may be increased in some instances, particularly where the pH is below 5.5.

Molybdenum may be applied as a seed treatment or as a foliar spray. As a seed treatment, one-half ounce of sodium molybdate per acre, or its equivalent, is recommended. As a foliar spray, one ounce of sodium or ammonium molybdate per acre in 8 to 12 gallons of water is recommended when or just before the soybeans begin to bloom. Seed treatment usually is more convenient and less expensive.

Fertilization - Hill area: In the Hill area, phosphate, potash, sulfur, molybdenum, and lime usually are needed for top yields. Nitrogen does not increase yields where lime and molybdenum are adequate and the soybeans are nodulated with effective strains of *Rhizobia*. Lime and fertilizer needs are best determined by a soil test. In the absence of a soil test, use a sulfur-containing mixed fertilizer of 0-1-1 ratio at a rate to supply about 50 pounds each of phosphate (P_2O_5) and potash (K_2O) and 4 to 8 pounds of sulfur per acre. On newly cleared land or unimproved pasture land, which usually is very deficient in phosphorus, use a fertilizer of 0-4-3 ratio at a rate to give 70 to 80 pounds of phosphate per acre for 3 to 4 years before switching to one of 0-1-1 ratios. If fertilizer of 0-4-3 ratio is unavailable, use one of 0-1-1 ratio at a rate to give about 70 pounds each of phosphate and potash per acre.

The fertilizer may be banded or broadcast. If banded, it should be placed 3 to 4 inches to one side and 3 to 4 inches deeper than the seed. Avoid contact placement with the seed as well as placement directly beneath the seed.

Where double cropping of soybeans and wheat is practiced, all of the phosphate and potash recommended for both crops may be applied to either crop. The fertilizer should be broadcast and worked into the soil.

A recent soil test summary shows that 70 percent of the soils tested for soybeans in the Hill area (excluding the Northeast Blacklands) need liming for top yields when molybdenum is not applied. At soil pH values below 5.5, liming not only increases the availability of molybdenum but also increases yields by correcting manganese and aluminum toxicity (especially manganese toxicity) which sometimes causes crop failure.

When molybdenum is applied only 30 percent of the soils tested need liming for top yields. The use of molybdenum on soils with pH of 5.5 or higher reduces the response of soybeans to lime because the major and possibly only result of liming is to increase the availability of native soil molybdenum. This in turn increases the nitrogen-fixing capacity of the nodule bacteria, which increases bean yields.

Farmers planning to apply lime should have their soils tested and apply lime first to those soils having a pH below 5.5. Even farmers who rent land for only one year may find it profitable to apply a ton of lime per acre, especially to soils of medium to coarse texture (sandy loam, silt loam and loams) with a pH below 5.5. On such soils, liming usually increases the yield two to four bushels per acre even though molybdenum is applied.

Many soils show some yield increase for molybdenum even when limed to pH 6.0 to 6.5. Accordingly, its use is recommended for soybeans on all soils of the Hill area, the rate and method of application being the same as for the Delta area.

Rice

Varieties: *Long Grain*-Starbonnet, Bluebelle and Labelle which mature in 135, 125 and 118 days, respectively. *Medium grain*-Nova 66 and Vista which mature in 130 and 123 days, respectively.

Seeding Dates and Rates: Rice can be seeded from mid-April to mid-June, depending upon variety. The very early maturing varieties should not be planted until June. Plant 90 to 110 pounds if drilled and 110 to 135 pounds if broadcast or water seeded.

Fertilization: Apply 110 to 135 pounds of nitrogen per acre on old cropland. New land will probably require no nitrogen for the first one or two years. The ammonium forms of nitrogen such as ammonium sulfate and urea are recommended. Nitrogen fertilizer may be applied: All at one time at the time the field is being flooded (full season, continuous flood must be maintained); or one-half when the field is being flooded and one-half at the correct "joint stage". This occurs when the first internode to elongate is one-half inch in length for Starbonnet, three-fourths inch in length for Bluebelle and Labelle, and one and one-half inches in length for Nova 66 and Vista. Nitrogen may be applied into the water; it is neither necessary nor advisable to drain the field prior to fertilization.

Sorghums for Grain or Silage

Varieties for Grain: DeKalb BR-64 and Acco 1093 are bird-resistant varieties with good yield potential and have the best resistance to the leaf and stalk disease, anthracnose. Anthracnose infection is unpredictable and may vary in severity from year to year. The following bird-resistant hybrids will yield well if anthracnose does not develop: Funk's BR 79, Funk's BR 630 and McNair 546.

Non-bird-resistant varieties such as Funk's G 522, DeKalb C-42y, DeKalb E-57 and Acco R 1090 may be damaged by birds, but have good disease resistance and are much more desirable for high quality grain than bird-resistant types.

Varieties for Silage: Commercial Hybrids.

Seeding Dates and Rates: Plant from April 20 to July 15. The earlier date is preferred because yields are higher and first harvest by July 25 permits a second cutting if soil moisture is adequate. Seed 5 to 7 lbs. per acre in rows.

Fertilization - Grain: In the Delta, generally only nitrogen is needed. *Test soils for phosphate and potash.* Depending upon the average yield, apply 80 to 130 pounds of nitrogen per acre: the lower rate for yields of 60 to 70 bushels per acre, the higher rate for yields of 100 to 120 bushels, and 100 pounds of nitrogen per acre for yields of 80 to 90 bushels.

In the Hills, phosphate and potash as well as nitrogen usually are needed. On good land, yields should be in the range of 80 to 100 bushels per acre and for such yields the nitrogen rate should be 100 to 120 pounds per acre. On other land, yields are likely to be lower and the nitrogen rate should be reduced to 70 or 80 pounds per acre. Both phosphate (P_2O_5) and potash (K_2O) should be applied at the rate of 30 to 40 pounds per acre.

Except on soils of very low productivity, or because of extreme weather conditions, yields should be in the range of 60 to 100 bushels per acre for early plantings where good cultural practices are followed. Average yields for late plantings (after July 1) are considerably lower.

Where a stubble crop is grown apply an additional 40 to 60 pounds of nitrogen per acre after the first crop.

Fertilization - Silage: Same as for grain except double the rate of potash.

Sorghums for Syrup

Varieties: Dale, Brandes, and Theis.

Seeding Dates and Rates: Sweet sorghum in Mississippi should be planted during the first half of May. Plant two pounds of seed per acre in 40-inch rows. The best spacing averages one plant every six inches in the drill or four plants every 24 inches in hills.

Fertilization: At planting, apply 40 to 50 pounds each of nitrogen, phosphate (P_2O_5) and potash (K_2O) per acre. No side-dressing should be applied later.

Harvesting: Sweet sorghum should be harvested in the dough stage of seed development for the maximum yield of high quality syrup. Syrup quality is improved by stripping the leaves, removing the heads and the top joint, and delaying milling for a week after the stalks are cut.

Sugarcane for Syrup

Varieties: Plant C.P. 36-111 and C.P. 67-500, on deep, well drained soils of light texture.

Seeding Dates and Rates: Cut seed cane at the top mature joint and at ground level, but do not strip before planting. Plant in the Fall (October 15) at the rate of two stalks, that is, place stalks end to end with a whole stalk at the union. Plant the cane in four-foot rows on land that has been broken five to six inches deep a few weeks earlier. To protect from cold and to provide good drainage, cover the cane six to eight inches deep by forming a ridge over it so that the drainage furrows between the rows are two to four inches deeper than the cane.

Fertilization: In the spring, apply 40 to 50 pounds each of nitrogen, phosphate (P_2O_5) and potash (K_2O) per acre shortly after germination of the eyes or just before regrowth from stubble. Place the fertilizer in a band so that it will be four to six inches to the side of the row and three to five inches deep after the ridges have worked down (one to two inches deeper than the cane).

Harvesting: Strip, top and cut the cane before freezing weather. Harvesting as much as a month before processing improves syrup quality and reduces "sugaring."

Peanuts

Varieties: *Spanish type*---Star, Tifspan, Spancross, Spanhoma, and Comet.

Runner type---Florunner

Virginia type---Florigiant

Growers should be sure of a market before choosing a variety or planting a marketable acreage.

Planting Dates: April 1 to May 1 in South Mississippi and April 15 to May 15 in North Mississippi.

Inoculation: Planting seed

lways should be inoculated with
e appropriate strain of *Rhizobia*.

Soils and Fertilization: Well
ained sandy loam soils should be
lected for peanuts---heavy soil
ay present harvesting problems.
il should be limed to a pH of 5.8 or
gher. Soils in the Western part of
e Delta generally do not require
rtilization for peanut production.

In other areas of the state, broadcast and plow-down 80 pounds each of phosphate and potash. The fertilizer should also contain enough boron to provide about 0.5 pounds per acre. A soil test is the best way to determine lime and fertilizer needs.

Peanuts do not require fertilization with nitrogen if properly inoculated. However, in some areas of the Southeast, 20 to 30 pounds of nitrogen per acre is recommended on Spanish types. Peanuts should not be planted behind either soybeans or peanuts. Crop residues should be buried deeply by plowing in the fall as a disease control measure. Commercial producers should check with their county agent for more details about production practices.

Grasses, Legumes, and Small Grains

Selection of Varieties: The use
certified seed will reduce the risk
infestation with noxious weed
ed and will result in better perfor-
ance.

Grass or Grass-Legume Mix-
res: In most instances a grass-
gume mixture will provide less ex-
nsive and more nutritious
sture forage than grass grown
one and fertilized with nitrogen.
oper use of forage legumes may
sult in better use of land
sources by increasing total
oduction, and extending the
azing season. Therefore, where
actical, new pastures should be
nted to the desired grass plus
e or more legumes. Major con-
lerations in the choice of the
gume species are the availability
d price of seed and the time that
age will be needed.

Grass-legume mixtures for
nter pastures sometimes "grow
" more slowly than grass alone
tilized with nitrogen; therefore,
nay be advisable to plant a por-
n of the winter pasture to grass
nall grain and ryegrass) alone
d fertilize with nitrogen as
ommended in the tables.

noculation of Clovers: All
ed of clovers and other forage
umes should be inoculated with
proper culture of *Rhizobia*
fore planting. *It is imperative*
at seeds of new clovers like
rowleaf be inoculated.

Planting: Where equipment is
ailable, drill or band placement
seed and fertilizer usually is
re effective for the establishment of most pasture and forage crops.

With small-seeded legumes and grasses, care must be taken not to plant the seed too deeply. A seeding depth of no more than ten times the diameter of the seed is recommended. Where plantings are made by broadcasting the seeds on the soil surface, it is advisable to cultipack the seedbed immediately after seeding.

Renovation of Grass-Legume Pasture: Where the stand of legumes in a pasture has degenerated to less than 15 percent or has been lost entirely, it would pay to reseed legumes. This is best done in the fall season. The pasture should be closely grazed or mowed for hay and the clover seed broadcast or drilled. A fertilizer containing phosphorus and potash should be applied, preferably as indicated by a soil test.

Fertilization General: For established pastures, solid and liquid complete fertilizers and solid sources of nitrogen may be top-dressed. On summer grass pastures, however, the efficiency of top-dressed urea-ammonium nitrate (non-pressure) solutions has been quite low compared to solid ammonium nitrate.

Because of the wide variety of soils to which these pasture recommendations will be applied, and of the extensive nature of the typical commercial livestock operation in Mississippi, particularly beef cattle, the pasture fertilizer recommendations are generally presented as a range instead of a single and more arbitary figure.

The lower limit of the recommendation is estimated to be sufficient for plant establishment and (1) for reasonable yields of forage on soils well adapted to the particular pasture crop under consideration, (2) for periods of economic stress during which it is still necessary to maintain a reasonable supply of cheap forage, and (3) where acreage per animal unit is not a serious limiting factor.

The upper limit of the fertilizer recommendations should be used where the (1) soil type, (2) management systems, (3) type of livestock enterprise, and (4) economic trend are such as to justify the considerably higher yields of forage.

An estimate of the fertilizer requirements for the production of 100 pounds of beef in different enterprises on soils testing low in phosphate and potash is shown in Table 1.

With current beef and fertilizer prices (Fall, 1974) it is not profitable to fertilize permanent pastures with phosphate and potash at soil test levels of medium and higher. Therefore, cattlemen are encouraged to test their soils and use phosphate and potash on those testing low to very low where the need is much more critical.

Fall application of phosphate or potash to pastures is recommended if these nutrients are necessary to establish forage seedlings in the fall. However, spring application is slightly more effective for spring and summer growth of perennial plants and those which come up in the spring. *In general, fertilizers should be applied as close as practical to the time they are to be used by plants, therefore seasonal, annual applications are indicated in Tables 2, 3 and 4. If phosphate and potash are applied only once in two years, double the annual application rate.*

Utilization of Forage: To insure maximum profit from fertilizer applied to pastures, livestock producers must adjust the stocking rate to use the additional forage efficiently.

Fertilization of Grass-Legume Mixtures: Grass-legume mixtures should be fertilized to meet the needs of the legume for phosphate, potash and lime. Liming practices and phosphate and potash rates that are sufficient for the legume will also be adequate for the grass. Because of symbiotic fixation by the nodule bacteria, legumes provides their own nitrogen and indirectly increase the amount of nitrogen available to grass. The application of nitrogen to grass-legume pastures reduces the nitrogen-fixing efficiency of the legume. Therefore, it usually is unwise to fertilize permanent grass-legume mixtures when the legume constitutes 15 percent or more of the stand.

Where permanent grass pastures are overseeded annually with crimson or arrowleaf clovers, or with a ryegrass-clover mixture, the application of nitrogen in late spring and early summer may be advantageous if additional forage is needed. It should be recognized that the extra forage must be reduced to a short stubble by intensive grazing or by close mowing for hay for successful overseeding or for obtaining stands where clovers have re-seeded.

Caution - Where conditions are especially favorable for legumes, the danger of bloat may prevent full utilization of legumes seeded alone, or of grass-legume mixtures such as Dallisgrass and white clover. The drilling of small grain or ryegrass (also orchardgrass in north Mississippi) into such a pasture will reduce the probability of bloat and supply additional forage.

Fertilization of Grass Pastures: The yield of grass forages is greatly increased by nitrogen fertilization and where weather conditions do not limit growth, excellent response is obtained to high rates of nitrogen. For example, the response of grasses such as Dallisgrass, common bermudagrass, sorghum-sudan hybrids, bahiagrass, and ryegrass-small grain mixtures is somewhat linear to rates of nitrogen as high as 200 to 300 pounds per acre, and for Coastal and Alicia bermudagrass this type of response may extend to rates greater than 400 pounds per acre. The mos economical rate of nitrogen will depend upon the weather, the efficiency of forage utilization and th economic trends.

To increase the efficiency o nitrogen and to obtain a mor favorable distribution of forag production, split applications o nitrogen are recommended for bot summer and winter pastures Applications may range from 45 t 80 pounds per acre. Except fo Coastal and Alicia bermudagras where the last application may b in early August, the last applica tion of nitrogen to permanen summer pastures should be mad by mid-July, and two weeks earli if anhydrous ammonia is use Because of the frequency drought, mid-summer applicatio of nitrogen are usually less effe tive than applications of nitroge are usually made in the spring an early summer.

For summer temporary grazin crops, one-half of the nitroge should be incorporated into th seedbed with phosphate an potash before planting. Th remainder should be applied in on or two applications after grazing cutting.

Caution: Excessive amounts nitrogen applied in a sing application may result in nitro poisoning, or contribute to gra tetany.

Table 1. Approximate Fertilizer Requirement for the Production of 100 Pounds of Beef from Pastures on Soils Testing Low in Phosphate and Potash when Fertilized as Recommended in Tables for the Hill Area.

	Enterprise and Pounds of Fertilizer for 100 Pounds of Beef					
	Cow-Calf[1]			Steer Grazing[2]		
Type of Pasture	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Coastal Bermuda	75	25	25	54	18	18
Bahiagrass, Dallisgrass, Common Bermuda, or Fescue	90	30	30	63	21	21
Ryegrass or Wheat -				54	24	12[3]
Ryegrass Mixture	138	60	30	75	34	17
Sorghum - Sudan Hybrid	138	46	46	75	25	25
Dallisgrass and/or Common Bermuda or Fescue with White Clover	0	64	64	0	42	42
Coastal Bermuda overseeded with Crimson or Arrowleaf Clover	0	64	64	0	42	42
Ryegrass-Crimson				0	30	30[3]
Clover Mixture	0	60	60	0	40	40

[1] Based on the annual feed requirements for maintenance and replacement of brood cows and sires and growth of calves to 450-500 pounds with a calf crop of 85 to 90 percent.

[2] Average grazing weight of 700 pounds.

[3] Average grazing weight of 500 pounds.

Table 2. Recommendations for Delta Pasture and Small Grain Crops

Pasture or Hay Crop	Recommended Varieties	Rate of Seeding Per Acre	Time of Planting	Fertilization, lbs.-A [1] Annual Application
Alfalfa	Cody, Delta and Florida 66	15-20 lbs.	Sept.-Nov.	Test soil for lime, Phosphorus, and potash needs
Bermudagrass	Coastal or Alicia	20 bu. sprigs. or 1200-1500 lbs. fresh forage disked in	Feb.-May - June-Aug.	150-240 lbs. N, 2-3 applications beginning June 1, for grazing; for Hay, 300-400 lbs. N
Bermudagrass White Clover	Regal or La.S-1	2 lbs.	Plant Clover Sept.-Nov.	Test soil for lime, phosphorus, and potash needs.
Fescue and White Clover	Kentucky-31 Regal, La.S-1, Nolin or Tillman	Fescue 10-15 lbs. Clover 3 lbs.	Oct.-Nov. Feb.-May	Test soil for lime, phosphate, and potash needs
Red Clover	Orbit, Kenland or Nolin's Red	10-15 lbs. seed alone or in small grains	Sept.-Nov.	Test for lime, phosphate, and potash.
White Clover	Regal, La.S-1 Nolin or Tillman	2-3 lbs.	Sept.-Nov.	Test soil for lime, phosphate and potash.
Arrowleaf Clover[4]	Meechee or Yuchi	12-15 lbs.	Sept.-Nov.	Test soil for lime, phosphate, and potash.
Sorghum-Sudan hybrids	Commercial Varieties	20 lbs. in rows 35 lbs. broadcast	Apr.-July	60 lbs. N prior to planting 60 lbs. N after 1st and 2nd cutting.
Korea Lespedeza	Climax or Summit	20-25 lbs. seed in small grains	Feb.-Apr.	Test soil for lime, phosphate, and potash.
Oats	Coker 227, Coker 234, or Florida 501	120 lbs. for grazing 90 lbs. for grain	For grazing: early Sept. For grain: mid-Oct.	Grazing: 120-180 lbs. N split-fall and spring. Grain: 50-60 lbs. N about March 1-March 15.
Wheat	Arthur 71 Coker 68-15	120 lbs. for grazing 90 lbs. for grain	Same as Oats	Grazing: Same as Oats Grain: 90-100 lbs. N about March 1.
Rye	Acco 118, Explorer, Elbon McNair's Vitagraze or Wren's Abruzzi	120 lbs. for grazing	Same as Oats	Grazing: Same as Oats Grain: 90-100 lbs. N about March 1.
Barley[5]	Dayton, Harrison, or Jefferson	Same asWheat	Same as Oats	Same as Oats

[1] All areas should be tested for lime, phosphorus, and potash needs.

[2] If irrigated, Coastal may be planted from April 1 to Sept. 1.

[3] Where clover disappears in the grass-clover mixture apply 60 lbs. in the fall.

[4] Specify scarified seed.

[5] Barley yields are generally quite low except in extreme North Mississippi. Barley yellow dwarf disease is a serious problem and none of the varieties are resistant.

Table 3. Recommendations for Pastures and Forages in Hill Area

Pasture of Hay Crop	Recommended Varieties	Rate of Seeding Per Acre	Time of Planting	Fertilization, lbs.-A [1] Annual Application
Established Warm Season Grasses (Permanent)				
Bahiagrass	Pensacola, Wilmington, (Argentine-South Mississippi only)	20 lbs./A	Feb.-May [2]	120-160 lbs. N in split applications and 30 to 40 lbs. each of P_2O_5 and K_2O. Total application in a 4-1-1 ratio.
Bermudagrass	Common	5lbs. seed	Feb.-May	Same as for Bahiagrass
	Coastal	20 bu. of sprigs	Feb.-May If irrigated plant as late as Sept. 1.	For Grazing: 120 to 200 lbs. N in split applications and 30 to 50 lbs. each of P_2O_5 and K_2O. Total application in a 4-1-1 ratio. For Hay: 200 to 300 lbs. N in split application; 50 to 90 lbs. of P_2O_5; 100 to 180 lbs. K_2O. Total application in a 4-1-2 ratio.
		1200 to 1500 lbs. fresh forage disked in	June-Aug.	
Dallisgrass	Commercial	10 lbs. (live seed)	Feb.-May	Same as Bahiagrass.
Johnsongrass	Commercial	15-25 lbs. (live seed)	April 1 to May 15	Same as for Coastal Bermudagrass
Established Cool Season Grasses (Permanent)				
Tall Fescue	Alta, Kentucky-31	15 lbs.	Sept.-Nov.	80 to 120 lbs. N, split-fall and spring; 40-60 lbs. each of P_2O_5 and K_2O in a 1:1 ratio.
Orchardgrass (North Miss. only)	Potomac or Boone	15 lbs.	Sept.-Nov.	Same as Tall Fescue
Warm Season Grass-Legume Mixtures (Permanent)				
Bahiagrass		As before	As before	Establishment: 60 to 90 lbs. of P_2O_5 and K_2O in a 1:1 ratio and 0.5 lbs. of boron Maintenance: 40 to 60 lbs. each of P_2O_5 and K_2O in a 1:1 ratio and 0.5 lbs. of boron.
Bermudagrass		As before		
Dallisgrass with one of the following legumes.				
White Clover	Regal, La.S-1 Nolin or Tillman	3 lbs.	Sept.-Nov.	
Crimson Clover	Dixie, Chief, Autauga or Tibbee	25 lbs.	Sept.-Nov.	Same as for White Clover

(Table 3 continued next page)

(Table 3. Continued from last page)

Arrowleaf Clover	Meechee or Yuchi	10-15 lbs.	Sept.-Nov.	Same as for White Clover
Annual Lespedeza	Climax or Summit	25 lbs.	Feb.-Apr.	Establishment: 60 lbs. each of P_2O_5 and K_2O in a 1:1 ratio. Maintenance: 40 lbs. each of P_2O_5 and K_2O.
Johnsongrass with One of the following for hay:	Commercial	15-25 lbs.	Feb.-June Sept.-Nov.	Establishment: 120 to 160 lbs. each of P_2O_5 and K_2O Maintenance: 60 to 80 lbs. P_2O_5 and 180 to 240 lbs. K_2O in a 1:3 ratio plus 1.0 lb. of boron
Alfalfa	Florida 66, Delta Cody	(live seed 15 lbs.	Sept.-Nov.	
Red Clover	Orbit, Kenland, Chesapeake, or Nolin's Red.	10 lbs.	Sept.-Nov. or March-April on clean land.	Same as with Alfalfa.
Rough Peas	Commercial, also known as Caley, Singletary, Wild Winter Peas	30 lbs.	Sept.-Oct.	60-90 lbs. P_2O_5 and 120 to 180 lbs. K_2O in a 1:2 ratio, 120 lbs. N after peas mature.
Warm Season Grasses (Annual or Temporary)				
Millet	All hybrid Varieties	15 lbs. in rows 35 lbs. broadcast	Apr.-June	120-150 lbs. N, split application; 60 lbs. P_2O_5 and 60 lbs. K_2O.
Sorghum-Sudan	Commercially available varieties	15 lbs. in rows 35 lbs. broadcast	Apr.-June	120 to 180 lbs. N in split applications; 60 lbs. P_2O_5 60 lbs. K_2O
Cool Season Grass-Legume Mixtures (Annual or Temporary)				
Annual Ryegrass with one of the following:	Gulf Magnolia, Blends (common in North Miss. only)	25 lbs.	Sept.-Nov.	60-80 lbs. each of P_2O_5 and K_2O in a 1:1 ratio at seeding time.
Arrowleaf Clover[3] Crimson Clover	Meechee or Yuchi Autauga, Chief Tibbee, or Dixie	10 lbs. 20 lbs.	Sept.-Nov. Sept.-Nov.	
Annual Ryegrass and wheat or oats with legumes (as with ryegrass	As above See wheat and oats	25 lbs. 90 lbs.	Sept.-Nov. Sept.-Nov.	Same as Above
Small Grains and Legume (Use same with ryegrass)	Oats, rye or wheat (see varieties under grass)	90 lbs. of small grain	Sept.-Nov.	Same as Above

Cool Season Grass-Legume Mixtures (Permanent)				
Tall Fesuce or Orchardgrass [1] with	Alta, Kentucky-31 or Goar Commercial, Boone or Potomac	10 lbs. in 20" rows 10 lbs.	Sept.-Nov. Sept.-Nov.	Establishment: 60 to 90 lbs. each of P_2O_5 and K_2O in a 1:1 ratio Maintanence: 40-60 lbs. each of P_2O_5 and K_2O in a 1:1 ratio.
White Cover	Regal, Tillman, La.S-1 or Nolin	3 lbs.	Sept.-Nov.	
Annual Cool Season Grasses and Small Grains				
Annual Ryegrass	Gulf or Magnolia (Common in North Miss. only)	30-40 lbs.	Sept.-Oct.	120 to 220 lbs. of N, split fall and spring; 60 to 80 lbs. P_2O_5 and 30 to 40 lbs K_2O in a 2:1 ratio
Barley (Grain only) [5]	Harrison, (Barsoy), Jefferson, Keowee or McNair 601	90 lbs.	Oct.-Nov.	10-20 lbs. N, 30-40 lbs. each of P_2O_5 and K_2O at seeding. Topdress with 60 to 90 lbs. N about March 1.
Oats	(North) Coker 242 Coker 234 or Coker 227 (South) Coker 227 Coker 234, or Fla. 501	For Forage: 120 lbs. For Grain 90 lbs.	For Forage Sept.-Nov. For Grain Oct.-Nov.	Same as Ryegrass. Same as Barley, use lower rate of nitrogen
Rye	Abruzzi, Balboa Elbon, Explorer Vitagraze	For Forage: 120 lbs. For grain: 90 lbs.	For Forage: Same as Oats For grain: Oct.-Nov.	Same as Ryegrass Same as Barley
Wheat	Abe, Arthur-71 Coker 68-15	For Forage: 120 lbs. For Grain: 90 lbs.	Same as for Rye	Same as Ryegrass. 10-20 lbs. N, 40 lbs. each of P_2O_5 and K_2O at planting. Topdress with 90 to 100 lbs. N about March 1.
Legumes [6]				
Alfaifa (Hay)	Florida 66, Delta, or Cody	15-20 lbs.	Sept.-Nov.	Establishment: 120 to 160 lbs. each of P_2O_5 and K_2C in a 1:1 ratio and 1.5 lbs. boron. Maintenance: 60-80 lbs. P_2O_5 and 180 to 240 lbs. K_2O in a 1:3 ratio and add 1 lb. boron

(Table 3. Continued from last page)

Arrowleaf Clover	Meechee or Yuchi	10 lbs.	Sept.-Oct.	60 lbs. each of P_2O_5 and K_2O in a 1:1 ratio for Seed-production add 0.5 to 1.0 lb. boron.
Austrian Winter Peas	Commercial	50 lbs.	Sept.-Oct.	Same as for Arrowleaf Clover
Crimson Clover	Autauga, Chief, Dixie or Tibbee	20-30 lbs.	Sept.-Oct.	Same as for Arrowleaf Clover
Lespedeza (Annual)	Climax, or Summit	25 lbs.	Feb.-Apr.	Same as for Arrowleaf Clover
Sericea (Perennial)	Serala, or Commercial	30 lbs.	Feb.-June	Same as for Arrowleaf Clover
Red Clover (Hay).,	Orbit, Kenland, Chesapeake, or Nolin's Red	10 lbs.	Sept.-Nov. Mar.-Apr.	Established: 60 to 90 lbs. each of P_2O_5 and K_2O in a 1:1 ratio. Maintenance: 50 lbs. P_2O_5 and 100 lbs. K_2O in a 1:1 ratio. Maintenance: 50 lbs. P_2O_5 and 100 lbs. K_2O in a 1:2 ratio.
Rough Pea	Commercial-also known as Singletary, Caley and Wild Winter peas.	40 lbs.	Sept.-Oct.	Same as for Arrowleaf Clover.
Vetch	Warrior	30 lbs.	Sept.-Oct.	Same as for Arrowleaf Clover
White Clover	Regal, La.-S1	3 lbs.	Sept.-Nov.	Same as for Arrowleaf Clover

[1] **Established stand. If clipped for hay, increase the K O rate about 30 pounds for each ton of hay. If phosphate and potash are applied on alternate years, double the annual rate.**

[2] **When irrigated, Coastal may be planted from April 1 to September 1.**

[3] **Specify scarified seed.**

[4] **Use orchardgrass in North Mississippi only.**

[5] **Barley yields are generally quite low except in extreme North Mississippi. Barley yellow dwarf disease is a serious problem and none of the varieties are resistant.**

[6] **All legume seed should be inoculated with the proper culture immediately before planting.**

Table 4. Recommendations For Lawns And Similar Turf Areas

Grass	Recommended Varieties	Method of Planting	Rate of Planting	Fertilization per 1000 Sq. ft. per Yr. [1]
Bahiagrass	Pensacola or Wilmington	Seed	5-10 lbs 1000 sq. ft.	6 lbs. nitrogen 2 lbs. P_2O_5 4 lbs. K_2O split into 4 applications
Bermudagrass	Common	Seed	2 lbs /1000 sq. ft.	6-8 lbs. nitrogen
	Tiflawn, Ormond Tifway or Tifdwarf	Sprig or plug	Sprig or plug 6-12 ins. apart on 6-12 in. rows	2 lbs. P_2O_5 3-4 lbs. K_2O split into 4 applications
		Stolonize	2-5 bu./1000 sq. ft	
Carpetgrass	Common	Seed	5 lbs/1000 sq. ft	2-3 lbs. nitrogen 1 lb. P_2O_5 1-2 lbs. K_2O, split into 2-3 applications
Centipedegrass	Common, or Oklawn	Seed or Sprig or plug	4 oz./1000 sq. ft Sprig or plug 6-12 ins. apart on 6-12 in. rows	Same as carpet
Fescue	K-31	Seed	7-10 lbs./1000 sq. ft	4 lbs. nitrogen (2 in fall, 2 in spring) 2 lbs. P_2O_5 and 4 lbs. K_2O
Ryegrass	Gulf or Magnolia	Overseed permanent lawns	8-10 lb./1000 sq. ft.	1 lb. nitrogen in January and March
St. Augustine grass	Common	Sprig or plug	Sprig or plug 6-12 in. apart on 6-12 in. rows	Same as bahia
Zoysiagrass	Emerald, Matrella, or Meyer	Sprig or plug	Sprig or plug 6 in. apart on6 in. rows	Same as bahia

[1] When establishing a new lawn incorporate 2-3 lbs. of N; 4-6 lbs. of P_2O_5 and 2-3 lbs. of K_2O per 1000 sq. ft. into the seedbed before planting.

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March 1975

Rice in Mississippi:
Production Practices, Costs and Returns

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Rice in Mississippi: Production Practices, Costs and Returns

Modern rice production in the lississippi Delta was begun ollowing World War II. Acreage of ice in Mississippi peaked at 79,000 1 1954. The price support program r rice, with strict acreage control, as implemented in 1955. Acreage lanted in Mississippi decreased to 2,000 in 1957, but by 1968 had ineased to 68,000. With allotment estrictions removed, an estimated 110,000 acres were planted in 1974. (1).*

This relatively new crop for Mississippi has become an important source of income. It has been estimated that the potential area suitable for annual rice production in the Delta of Mississippi is approximately 400,000 acres, based on an estimate of 800,000 acres suitable for rice production with a one and one rotation. (2).

When rice production was first introduced to Mississippi, the technology and practices followed in older rice producing areas were prevalent. Through trial and error and research the cultural practices that are presently being followed have evolved.

THE PROBLEM

Rice producers are constantly aking adjustments in resource se and production practices as ey respond to changing techology and economic conditions. dequate information about the roduction practices followed and e costs of producing rice is not urrently available on rice production in the Delta area of Mississippi.

This information is particularly needed since acreage controls have been removed from rice production and many current producers are considering increased acreage while others are considering rice production for the first time. Information on physical inputs is needed to facilitate additional research efforts. Agricultural leaders and policy-makers need current information on rice production as well as other enterprises in the agricultural industry.

OBJECTIVES

The major objective of the study as the up-dating of previous esearch[1] to improve the informaon that rice producers need for production and management decision making. Our specific objectives were to describe current production practices on rice farms and to estimate costs and returns per acre of rice in the Delta area of Mississippi.

TYPES OF SOILS

Rice is well suited to both the clay d mixed soils which comprise a gh proportion of the cropland in e Delta area of Mississippi. The clay soils are slowly permeable with relatively poor surface and internal drainage; however, they are satisfactory for rice production. Practically all of the rice in the Delta is produced on heavy clay soils.

VARIETIES GROWN

Three major varieties of rice tarbonnet, Bluebonnet 50 and luebelle) are produced in Mississippi. The predominant variety is Starbonnet, (a mid-season maturing variety) while Bluebelle and other early maturing varieties are of lesser importance.

IRRIGATION

Irrigation wells average about 0 feet in depth with pump size nging from 8 to 12 inches. The erage capacity per well is about 300 gallons per minute.

Water usually is maintained on rice fields for a period ranging from 90 to 120 days. The period varies with varieties and with dates of planting for a given variety. The most prevalent practice is continuous flooding; however, some rice producers drain and reflood as a means of maintaining some control over the rice water weevil.

**Numbers in parentheses refer to Literature Cited at the end of this publication.*

[1] *Much of the information presented in this publication is a current revision of results presented by iemeyer.* [2]

1975
PPI STATE UNIVERSITY

PRODUCTION PRACTICES

Methods of preparing land, particularly the timing of the initial tillage operations, vary with the rotation program used. Some farmers use rotation periods of 3 to 4 years in which rice is grown for one or for two years in succession on the same land which is then free of rice from 1 to 2 years. Rice following rice usually allows more intensive land preparation including some fall plowing; however, the prevailing practice is to produce rice on land that grew another crop, usually soybeans, the previous season. This limits the land preparation that can be done in the fall, and may increase the weather risks associated with spring field operations.

Preplant Land Tillage---The major land preparation operations are one chisel plowing and three diskings (Table 1). Some farmers use land-planes or similar leveling devices to improve the surface condition of their fields, generally on only part of their land each year. Piping[2] now is becoming a common practice.

Seeding Operations---Rice is usually seeded before the levees are raised. While seeding by air is the most common practice in the Delta, seeding may be done with grain drills and/or endgate seeders.

Levee Construction---Levees are completed immediately after the planting operations are finished. Levees are commonly established on contour, 0.2 to 0.3 feet apart in vertical drop. As the levees are located with the engineer's level, they are marked with a single sweep. The levees are raised to the desired height by pulling with a levee plow. Some farmers prefer to perform the final operations with a levee "squeeze", which is a V-type drag designed to reduce seepage by packing the heavy soil. Seeding of levees is accomplished on the last trip for levee construction.

In levee construction, the ends are filled or "butted" where each cross levee connects with the border levees. Openings are made in each of the cross levees at regular intervals to allow water passage during the period of germination and until the flood is applied. These filling and cutting operations are normally done with scoops mounted on small tractors. Some hand shoveling is usually necessary to complete the levee building operations.

Herbicide Application---Aerial application of herbicides is generally used. Most farmers use propanil for the first application to kill barnyard grass when it is in the second to fourth leaf stage. This application is usually followed with 2,4,5-T for the second application to kill hemp sesbania (coffeebean) and various broadleaf weeds (morningglory, redstem, cocklebur, etc.) that are prevalent in practically all rice fields in the Delta.

Watering Practices---The principal functions of water cover are to eliminate the competition of weeds and grasses that otherwise could not be controlled, to prevent serious loss of nitrogen through denitrification and to supply moisture for the rice. Water cover also conditions the soil and provides a favorable environment for the growth of rice. Hence, the application and management of water is a key operation in rice farming.

The first flood is applied as early as possible after the rice seed germinate and a stand is established. Under favorable weather, this may be about two weeks after planting, but if germination is slow three weeks may elapse before the first flooding. Flushing the field to germinate seed is a common practice when soil moisture is low. Applic
tion of the first flood requires clo
attention to avoid breakage
levees, and to stabilize the water
the desired level. If the levees a
accurately located and well co
structed, labor requirements can
reduced considerably.

During the remainder of tl
watering period a daily check of tl
water level between levees,
seepage areas or potential lev
breaks, and of the operating con
tion of the pump and motor co
prise the daily routine.

Fertilizer Application---Pra
tically all farmers apply nitrog
only, usually in the form of ur
because high analysis urea is t
most economical source of nitrog
and urea does not denitrify
water. Rice, especially wh
young, utilizes the ammoniu
form of nitrogen better than t
nitrate form. Fertilizer is usually
split applications. Farmers n
mally furnish two flagmen to gui
the pilot in applying fertilizer, a
one to three men as helpers
loading the plane. The charge
custom application of fertilizer
on a hundredweight basis.

Harvesting Operations---Rice
harvested with self-propelled co
bines. The time required and
cost of harvesting depend larg
upon the weather at harvest tir
Heavy rain and/or wind of
cause excessive lodging, and cre
unfavorable surface conditions
operating combines and ot
equipment.

The operations involved in h
vesting are combining, tra
ferring the grain to trucks, a
hauling. A typical complemen
man and machine includes
combines and drivers; one gr
cart; tractor and driver; two tru
and drivers; and one extra man a
standby tractor at the field.

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[2] *Piping is the towing of a large steel pipe which helps to establish a firm seedbed and levels the field ir single operation.*

Table 1. Estimated cost per acre by operation, rice, usual practices, Mississippi Delta 1975.

Operation or Cost Description	Unit	MO[1]	TR[2]	Times Over	Tractor				Equipment				Labor Hours			Labor Cost				Material			Miscellaneous			
					Hours	Direct Cost	Fixed Cost	Sum	Hours	Direct Cost	Fixed Cost	Sum	Comm	Oper	Spec	Comm	Oper	Spec	Sum	Quan	Price	Cost	Quan	Price	Cost	Total
Burn	Hour	11	0	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00	.02	.00	.00	.02	.00	.0000	.00	.00	.0000	.00	.02
Disk Levee	Acre	4	4	1.00	.04	.17	.09	.26	.04	.04	.08	.12	.00	.04	.00	.00	.09	.00	.09	.00	.0000	.00	.00	.0000	.00	.47
Chisel-16 ft	Acre	4	4	1.00	.22	.94	.48	1.42	.22	.14	.30	.44	.00	.22	.00	.00	.51	.00	.51	.00	.0000	.00	.00	.0000	.00	2.37
Disk-21 ft	Acre	4	4	3.00	.42	1.79	.92	2.71	.42	.93	1.68	2.61	.00	.42	.00	.00	.97	.00	.97	.00	.0000	.00	.00	.0000	.00	6.29
Pipe	Acre	4	4	1.00	.10	.43	.22	.65	.10	.03	.09	.12	.00	.10	.00	.00	.23	.00	.23	.00	.0000	.00	.00	.0000	.00	1.00
Labor	Hour	5	0	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.07	.00	.00	.16	.00	.00	.16	.00	.0000	.00	.00	.0000	.00	.16
Seed	Lb	5	0	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	120.00	.2650	31.80	.00	.0000	.00	31.80
Plant C.A.	CWT	5	0	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.0000	.00	1.35	2.0000	2.70	2.70
					.00	.00	.00	.00	.00	.00	.00	.00	.07	.00	.00	.16	.00	.00	.16			31.80			2.70	34.66
Cover Seed	Acre	5	4	1.00	.14	.60	.31	.90	.14	.31	.56	.87	.00	.14	.00	.00	.32	.00	.32	.00	.0000	.00	.00	.0000	.00	2.10
Level	One	5	0	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.0000	.00	1.00	.1700	.17	.17
Labor	Hour	5	0	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.24	.00	.00	.55	.00	.00	.55	.00	.0000	.00	.00	.0000	.00	.55
Labor (Rice Man)	Hour	5	0	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.12	.00	.00	.36	.36	.00	.0000	.00	.00	.0000	.00	.36
Survey and Mark	Acre	5	1	1.00	.12	.39	.18	.56	.12	.00	.00	.00	.00	.12	.00	.00	.28	.00	.28	.00	.0000	.00	.00	.0000	.00	.84
					.12	.39	.18	.56	.12	.00	.00	.00	.24	.12	.12	.55	.28	.36	1.19			.00			.17	1.92
Pull Levee	Acre	5	4	3.00	.36	1.54	.79	2.33	.36	1.26	2.70	3.96	.00	.36	.00	.00	.83	.00	.83	.00	.0000	.00	.00	.0000	.00	7.11
Seed	Lb	5	0	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	11.00	.2650	2.91	.00	.0000	.00	2.91
Pull - Reseed Levy	Acre	5	4	1.00	.05	.21	.11	.32	.05	.18	.38	.56	.00	.05	.00	.00	.11	.00	.11	.00	.0000	.00	.00	.0000	.00	1.00
					.05	.21	.11	.32	.05	.18	.38	.56	.00	.05	.00	.00	.12	.00	.12			2.91			.00	3.91
Butt Levee	Acre	5	4	1.00	.12	.51	.26	.78	.12	.09	.23	.32	.00	.12	.00	.00	.28	.00	.28	.00	.0000	.00	.00	.0000	[illegible]	1.37
Propanil	Lb	5	0	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	4.00	2.0700	8.28	.00	.0000	.00	8.28
Labor	Hour	5	0	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00	.00	.05	.00	.00	.05	.00	.0000	.00	.00	.0000	.00	.05
App Propanil C.A	Acre	5	0	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.0000	.00	1.00	2.5000	2.50	2.50
					.00	.00	.00	.00	.00	.00	.00	.00	.02	.00	.00	.05	.00	.00	.05			8.28			2.50	[illegible]
Labor (Rice Man)	Hour	5	0	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.12	.00	.00	.36	.36	.00	.0000	.00	.00	.0000	.00	[illegible]
Set Spills	Hour	5	0	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.12	.00	.00	.28	.00	.00	.28	.00	.0000	.00	.00	.0000	.00	.28
					.00	.00	.00	.00	.00	.00	.00	.00	.12	.00	.12	.28	[illegible]	[illegible]	.64			.00			.00	.64
Labor (Rice Man)	Hour	5	0	1.00	.00	.00	.00	.00	.00	.00	.00	.00	[illegible]	.00	.25	[illegible]	[illegible]	.75	.75	.00	[illegible]	.00	.00	[illegible]	.00	[illegible]
Flood Adj Spills	Hour	5	0	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.25	.00	.00	.58	.00	.00	.58	.00	[illegible]	.00	.00	[illegible]	.00	.58
					.00	.00	.00	.00	.00	.00	.00	.00	.25	.00	.25	.58	[illegible]	.75	[illegible]			.00			.00	[illegible]
Urea (Solid 45)	CWT	6	0	1.00	.00	.00	.00	.00	.00	.00	.00	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.33	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Labor	Hour	6	0	1.00	.00	.00	.00	.00	.00	.00	[illegible]	[illegible]	.02	.00	.00	[illegible]	[illegible]	[illegible]	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
App Urea C.A	CWT	6	0	1.00	.00	.00	.00	.00	.00	.00	[illegible]	.00	[illegible]	.00	[illegible]	[illegible]	[illegible]	.00	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]	2.67	[illegible]
					.00	.00	.00	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.00	[illegible]			[illegible]			2.67	[illegible]
2,4,5 T	Lb	7	0	1.00	.00	.00	.00	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.00	[illegible]	1.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Labor	Hour	7	0	1.00	.00	.00	.00	.00	[illegible]	[illegible]	.00	.00	[illegible]	.00	.00	[illegible]	[illegible]	.00	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
App 2,4,5 T C.A	Acre	7	0	1.00	.00	.00	.00	.00	[illegible]	.00	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.00	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
					.00	.00	.00	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.00	[illegible]			[illegible]			[illegible]	[illegible]
Urea (Solid-45)	CWT	7	0	1.00	.00	.00	.00	.00	[illegible]	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.00	[illegible]	1.33	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Labor	Hour	7	0	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00	[illegible]	[illegible]	[illegible]	.00	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
App Urea C.A	CWT	7	0	1.00	.00	.00	.00	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.00	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
					.00	.00	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]	.02	[illegible]	[illegible]	[illegible]	[illegible]	.00	[illegible]			[illegible]			[illegible]	[illegible]
Tend Water	Hour	7	0	1.00	.00	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.66	[illegible]	[illegible]	7.98	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Drain	Hour	8	0	1.00	.00	.00	.00	[illegible]	[illegible]	[illegible]	.00	[illegible]	[illegible]	.60	.25	[illegible]	[illegible]	[illegible]	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combine	Acre	9	0	1.00	.00	.00	[illegible]	[illegible]	.75	15.22	21.36	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tow Tractor	Acre	9	4	1.00	.00	.00	[illegible]	[illegible]	.75	1.27	[illegible]	6.46	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cart	Acre	9	4	1.00	.44	1.88	.96	2.84	.44	[illegible]	.69	[illegible]	.00	.44	[illegible]	[illegible]	1.01	[illegible]	1.01	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Haul	Bu	9	0	1.00	.00	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Store Dry	Bu	9	0	1.00	.00	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Trun Load Out	Bu	[illegible]	0	1.00	.00	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Water Cost	Acre	10	0	1.00	.00	.00	[illegible]	[illegible]	[illegible]	24.94	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total					2.01	8.46	[illegible]	[illegible]	[illegible]	41.77	46.06	[illegible]	[illegible]	2.01	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]			[illegible]	[illegible]

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[1] Month operation is generally accomplished. Weather permitting, land preparation and planting could be accomplished earlier.

[2] 1 designates an 80-90 DBHP tractor and 4 designates a 110-120 DBHP tractor.

major job for this extra man and standby tractor is to pull out stuck combines and rice carts. If the rice is delivered to commercial storage, no help at the commercial facility is furnished by the operator. Operators of small farms often harvest with one combine, but it is a common practice to exchange work with neighbors in order to form crews of two or more combines.

Rice Storage and Drying Facilities---After rice is harvested, it is either stored and dried on the farm or taken to off-farm commercial storage and drying facilities. Most of the rice produced in Mississippi is dried and stored on the farm. (3)

As the rice crop leaves the on-farm storage and drying facilities, its first destination is either a rice mill or a grain elevator. Most of the stored rice leaves the farm and goes directly to the rice mill. The costs per acre of storing and drying, turning and loading and hauling out are directly related to yield. *An assumed yield of 95 bushels per acre is estimated for computing the costs reported in this study* (Table 1).

ESTIMATION TECHNIQUE

In the decision-making process of evaluating the profitability of alternative enterprises, physical resource requirements and costs and returns information for each enterprise are necessary. To facilitate comparison between enterprises, these data were estimated on a per acre basis.

Estimates of input prices used in this study were obtained from farm supply outlets. Estimated 1975 costs of new machinery and equipment items were obtained from dealers and 1975 input prices were used.

The items of equipment selected are considered adequate and typical for rice production. Total equipment costs per hour include depreciation, interest, fuel, repairs, and maintenance. General overhead costs such as insurance, taxes and housing were not included, since these costs are not as readily attributable to specific enterprises but rather to the entire operation of the farm.

The determinants of tractor and equipment costs per acre---length of life, hours of annual use, new cost, repair cost and performance rate---were estimated.[3] This procedure assumes that new equipment is purchased, and that all equipment is used until zero salvage value is reached.

Variable costs for each item included total repairs and maintenance costs, both calculated as a percentage of new costs. The total was divided by annual hours of use to convert the variable costs to a per hour basis. Total variable costs per acre were determined by multiplying the variable costs per hour by the performance rate for the specified item of equipment.

Depreciation per hour was determined by dividing the new cost of the specified item by the total hours of use for the life of the equipment. Interest on operating capital was charged at an annual rate of 9 percent. Total fixed costs per acre were determined by multiplying the per hour fixed costs by the performance rate for the specified item of equipment.

Table 2. Estimated cost per acre, rice, usual practices, Mississippi Delta, 1975.

Item	Unit	Quantity	Price	Amount
			---dollars---	
Direct Expense				
Common Labor	hr	.77	2.30	1.77
Operator Labor[1]	hr	2.01	2.30	4.62
Special Labor	hr	4.90	3.00	14.70
Seed	lb	131.00	.27	34.71
Plant C.A.[2]	cwt	1.35	2.00	2.70
Level	ea	1.00	.17	.17
Propanil	lb	4.00	2.07	8.28
App Propanil C.A.[2]	ac	1.00	2.50	2.50
Urea (Solid-45)	cwt	2.67	7.00	18.66
App Urea C.A.[2]	cwt	2.67	2.00	5.33
2,4,5-T	lb	1.00	3.96	3.96
App 2,4,5-T C.A.[2]	ac	1.00	3.00	3.00
Special Equipment	ac	1.00	44.43	44.43
Equipment	ac	1.00	3.34	3.34
Tractor	ac	1.00	8.46	8.46
Int on Op Cap	ac	1.00	8.56	8.56
Haul	bu	95.00	.11	10.45
Store - Dry	bu	95.00	.27	25.65
Turn - Load Out	bu	95.00	.02	1.90
Total Direct Expense				203.20
Fixed Expenses				
Special Equipment	ac	1.00	39.35	39.35
Equipment	ac	1.00	6.71	6.71
Tractor	ac	1.00	4.32	4.32
Total Fixed Expense				50.38
Total Specified Expenses				253.58

[1] Driver Time For Tractors
[2] Custom Air

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[3] *Equipment costs reported in Table 1 include towed equipment and self propelled equipment.*

able 3. Estimated cost per acre, rice, usual practices, Mississippi Delta, 1975.

Operation or Cost Description	Unit	MO	Direct Cost	Fixed Cost	Direct Cost	Fixed Cost	Labor Cost	Material Cost	Misc Cost	Total Cost
							Dollars			
urn	Hour	11	.00	.00	.00	.00	.02	.00	.00	.02
isk Levee	Acre	4	.17	.09	.04	.08	.09	.00	.00	.47
hisel-16 ft.	Acre	4	.94	.48	.14	.30	.51	.00	.00	2.37
isk-21 ft.	Acre	4	1.79	.92	.93	1.68	.97	.00	.00	6.29
ipe	Acre	4	.43	.22	.03	.09	.23	.00	.00	1.00
lant C.A.	CWT	5	.00	.00	.00	.00	.16	31.80	2.70	34.66
over Seed	Acre	5	.60	.31	.31	.56	.32	.00	.00	2.10
urvey & Mark	Acre	5	.39	.18	.00	.00	1.19	.00	.17	1.92
ull Levee	Acre	5	1.54	.79	1.26	2.70	.83	.00	.00	7.11
ull Reseed Levee	Acre	5	.21	.11	.18	.38	.11	2.91	.00	3.91
utt Levee	Acre	5	.51	.26	.09	.23	.28	.00	.00	1.37
pp Propanil C.A.'	Acre	5	.00	.00	.00	.00	.05	8.28	2.50	10.83
et Spills	Hour	5	.00	.00	.00	.00	.64	.00	.00	.64
lood-Adj Spills	Hour	5	.00	.00	.00	.00	1.33	.00	.00	1.33
pp Urea C.A.	CWT	6	.00	.00	.00	.00	.05	9.33	2.67	12.04
pp 2,4,5-T C.A.	Acre	7	.00	.00	.00	.00	.05	3.96	3.00	7.01
pp Urea C.A.	CWT	7	.00	.00	.00	.00	.05	9.33	2.67	12.04
end Water	Hour	7	.00	.00	.00	.00	7.98	.00	.00	7.98
rain	Hour	8	.00	.00	.00	.00	.75	.00	.00	.75
ombine	Acre	9	.00	.00	15.22	21.36	2.25	.00	.00	38.83
ow Tractor	Acre	9	.00	.00	4.27	2.19	2.25	.00	.00	8.71
art	Acre	9	1.88	.96	.36	.69	1.01	.00	.00	4.90
aul	Bu	9	.00	.00	.00	.00	.00	.00	10.45	10.45
tore - Dry	Bu	9	.00	.00	.00	.00	.00	.00	25.65	25.65
urn - Load Out	Bu	10	.00	.00	.00	.00	.00	.00	1.90	1.90
ater Cost	Acre	10	.00	.00	24.94	15.80	.00	.00	.00	40.74
otal Specified Costs			8.46	4.32	47.77	46.06	21.09	65.62	51.70	245.02
iterest on Operating Capital										8.56
otal Specified Costs Including Interest on Operating Capital										253.58

ESTIMATED COSTS[4]

otal cost of producing an acre of is estimated to be $253.58 ble 2). Direct cost (variable cost) ounts for 80 percent of the total l the cost of operating special ipment---self-propelled ma- hery, the tow tractor and water- equipment---is the largest gle item of variable expense ($44.43 for the equipment and payment of $14.70 to special labor for operating the equipment and for marking and surveying levees and tending water---setting and adjusting spills, etc.).

Watering cost alone accounts for almost 20 percent of the total---$40.74 per acre outlay for water plus a $7.98 payment to labor for tending water (Table 3). Watering cost plus combining at $38.83, planting at $34.66 and storing and drying at $25.65 accounts for almost 60 percent of the estimated total cost of producing an acre of rice in 1975.

Costs are based on usual practices in the Delta area of Mississippi and were computed by using estimated '75 prices obtained from suppliers of production inputs.

ESTIMATED RETURNS

A rice producer following usual production practices and expecting a 95 bushel per acre yield could expect a $150.17 per acre return to land and management with rice priced at $4.25 per bushel. Since price, yield and costs are variable (costs of hauling, storing-drying, and turning and loading out vary with yield) the $150.17 return per acre serves only as a bench-ma Consequently, we estimated turns to land and management three levels of production and three prices for rice (Table 4).

Table 4. Estimated per acre returns to land and management, selected prices and yields, rice, usual practices, Mississippi Delta, 1975.

Yield	Price per bushel 3.00	4.25	5.50
Bu. -	Dollars		
80.00	-7.58	92.42	192.42
95.00	31.42	150.17	268.92
110.00	70.42	207.42	345.42

SUMMARY AND IMPLICATIONS

Rice producers in the Delta area of Mississippi responded to the lifting of acreage controls by expanding acreage to a record high of 110,000 acres in 1974. The value of this production is approximately $55 million dollars[5] and is a major contribution to the economy of Mississippi.

The Mississippi rice producer is presently faced with considerable uncertainty with regard to government action that might involve changes in such crucial areas as acreage controls, export restrictions and price restrictions. Additionally, the currently available commercial facilities for drying and storage are such that most Mississippi rice producers must provide on-farm drying and storage.

In this study, the direct cost of producing rice in the Mississippi Delta in 1975 was estimated to $203.20. Fixed expense for 1 was estimated at $50.38 and to specified expense was estimated be $253.58. With an assumed yi of 95 bushels per acre, a price $4.25 per bushel, and specified penses of $253.58, Mississippi producers would realize a return above specified expenses $150.17 per acre in 1975.

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[5] *Based on an assumed yield of 100 bushels per acre and a price of $5.00 per bushel.*

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PLANNING INFORMATION, COTTON AND SOYBEANS, MISSISSIPPI DELTA, 1975

By D. W. Parvin, Jr. and J. M. Anderson

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FOREWORD

This publication was prepared for farmers and other individuals already familiar with the production of cotton and soybeans in the Mississippi Delta. The primary purpose of the manuscript is to report production costs expected to be appropriate for the 1975 crop year. Additionally, current production practices and returns are discussed.

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PLANNING INFORMATION, COTTON AND SOYBEANS, MISSISSIPPI DELTA, 1975

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INTRODUCTION

Information about current practices and costs of producing cotton and soybeans is needed by producers, researchers, extension specialists, lending agencies, producers of agricultural inputs, purchasers of agricultural output, and others working in the agricultural and agribusiness sectors of the economy. Producers especially need planning information at this time. This publication has been prepared to report estimated production costs for cotton and soybeans for the Mississippi Delta for the 1975 crop year. Additionally, for selected yields and prices, a section on estimated returns above specified costs is presented.

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PROCEDURE

The basic technique utilized in this report is budgeting.[1] Data on practices were collected during July and August, 1974. Selected producers who were known to keep detailed records and who followed practices representative of the practices currently employed to produce cotton and soybeans in the Mississippi Delta, were interviewed. Tractor and equipment prices used in this report were obtained from retail dealers in the Delta area during late November and December, 1974. Prices of other agricultural inputs were obtained by interviewing the major suppliers of agricultural inputs in the Mississippi Delta. Prices used for all inputs in this report are those expected[2] to prevail in the Spring of 1975.

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[1] Budgeting is the costing of an enterprise on an operation by operation basis.

[2] These expected prices are late 1974 prices adjusted by the authors after consultation with individuals known to be familiar with prices in their respective fields.

BUDGETS

Estimated Costs Per Acre

Estimated costs per acre, by operation, for three cotton and two soybean budgets based on 6-row equipment are presented in Tables 1-5. production practices are those occurring most frequently in the Delta. The tractor costs are for a 100-110 DBHP[3/] tractor used 1,000 hours each year. Equipment costs reflect varying hours of annual use ranging from 100 for cotton and soybean planters to 350 for high clearance sprayers. Cotton pickers and combines were assumed to be used 200 hours each year. Labor cost is $2.30 per hour. The column entitled "Misc. Costs" includes custom operations and those operations such as hauling and ginning which are not divided into tractor, equipment, and labor charges or into direct and fixed cost. Hauling and ginning are the only operations in this report assumed to be proportional to yield.

Solid Cotton, Sandy Soil.--Table 1 reports estimated cost per acre for solid cotton, sandy soil, usual input practices, 6-row equipment[4/] for the Mississippi Delta in 1975. The first operation entitled "Apply Lime X 1/4" indicates that lime is applied every fourth year. The operation entitled "Apply Ins Air X 3" reflects three separate aerial

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[3/] Drawbar horsepower - Nebraska rating.

[4/] All information presented in this report pertains to usual input practices and 6-row equipment.

Table 1. Estimated cost per acre, solid cotton, sandy soil, usual input practices, 6 row equipment, Louisiana - Mississippi Delta, 1975.

Operation Description	Month	---Tractor---- Direct Cost	Fixed Cost	---Equipment-- Direct Cost	Fixed Cost	Labor Cost	Material Cost	Misc. Cost	Total Cost
Apply Lime X 1/4	11	.00	.00	.00	.00	.00	.00	9.38	9.38
Stalk Shredder 2 row	11	.99	.48	.05	.20	.69	.00	.00	2.41
Chisel Plow 16 ft	3	.94	.48	.15	.33	.51	.00	.00	2.41
Chisel Plow 16 ft	3	.94	.48	.15	.33	.51	.00	.00	2.41
Disk + Incor 21 ft	3	.77	.39	.56	.96	.41	3.05	.00	6.15
Disk Harrow 21 ft	3	.60	.31	.34	.62	.32	.00	.00	2.19
Field Cult 21 ft	3	.43	.22	.14	.31	.23	.00	.00	1.33
Disk Bed	4	.56	.28	.16	.27	.30	.00	.00	1.57
Disk Bed + Fert	4	.68	.35	.24	.40	.37	10.06	.00	12.11
Row Condition	5	.77	.39	.42	.80	.41	.00	.00	2.80
Plant + Pre	5	.85	.43	.42	.93	.91	13.39	.00	16.93
Trailer	5	.07	.03	.04	.08	.37	.00	.00	.59
Cultivate Early	5	.90	.46	.19	.37	.48	.00	.00	2.40
Apply Ins Ground	5	.00	.00	.45	.34	.18	.92	.00	1.89
Cult + Post Early	5	1.02	.53	.29	.56	.55	1.15	.00	4.11
Cult + Post Early	6	1.02	.53	.29	.56	.55	3.37	.00	6.32
Hand Weed Control	6	.00	.00	.00	.00	9.20	.00	.00	9.20
Cult + Post Late	6	.77	.39	.22	.42	.41	3.37	.00	5.59
Cult + Post Late	6	.77	.39	.22	.42	.41	1.63	.00	3.85
Hand Weed Control	7	.00	.00	.00	.00	9.20	.00	.00	9.20
Cult + Post Late	7	.77	.39	.22	.42	.41	6.76	.00	8.98

Table 1. Continued.

Operation Description	Month	---Tractor---- Direct Cost	Fixed Cost	---Equipment-- Direct Cost	Fixed Cost	Labor Cost	Material Cost	Misc. Cost	Total Cost
Insect Scouting	7	.00	.00	.00	.00	.00	.00	1.50	1.50
Apply Ins Ground X 2	7	.00	.00	.90	.68	.37	7.33	.00	9.27
Apply Ins Air X 3	8	.00	.00	.00	.00	.07	10.99	2.40	13.46
Apply Ins Air X 2	9	.00	.00	.00	.00	.05	5.13	1.60	6.77
Defoliate - Air	9	.00	.00	.00	.00	.00	2.62	1.65	4.27
1st Pick 2 row	10	.00	.00	13.67	21.76	3.63	.00	.00	39.06
Haul	10	.00	.00	.00	.00	.00	.00	6.63	6.63
2nd Pick 2 row	10	.00	.00	7.15	11.37	1.90	.00	.00	20.42
Haul	10	.00	.00	.00	.00	.00	.00	1.66	1.66
Gin	10	.00	.00	.00	.00	.00	.00	58.40	58.40
Total Specified Costs		12.83	6.56	26.26	42.14	32.46	69.77	83.21	273.23
Interest on Operating Capital									6.15
Total Specified Cost Including Interest on Operating Capital									279.38

Table 2. Estimated cost per acre, 2x1 cotton, land basis, sandy soil, usual input practices, 6 row equipment, Louisiana - Mississippi Delta, 1975.

Operation Description	Month	---Tractor---- Direct Cost	---Tractor---- Fixed Cost	---Equipment-- Direct Cost	---Equipment-- Fixed Cost	Labor Cost	Material Cost	Misc. Cost	Total Cost
Apply Lime X 1/4	11	.00	.00	.00	.00	.00	.00	9.38	9.38
Stalk Shredder 2 row	11	.66	.32	.03	.13	.46	.00	.00	1.62
Chisel Plow 16 ft	3	.94	.48	.15	.33	.51	.00	.00	2.41
Chisel Plow 16 ft	3	.94	.48	.15	.33	.51	.00	.00	2.41
Disk + Incor 21 ft	3	.77	.39	.56	.96	.41	3.05	.00	6.15
Disk Harrow 21 ft	3	.60	.31	.34	.62	.32	.00	.00	2.19
Field Cult 21 ft	3	.43	.22	.14	.31	.23	.00	.00	1.33
Disk Bed	4	.56	.28	.16	.27	.30	.00	.00	1.57
Disk Bed + Fert	4	.68	.35	.24	.40	.37	6.76	.00	8.81
Row Condition	5	.77	.39	.42	.80	.41	.00	.00	2.80
Plant + Pre	5	.85	.43	.42	.93	.91	8.99	.00	12.53
Trailer	5	.07	.03	.04	.08	.37	.00	.00	.59
Cultivate Early	5	.90	.46	.19	.37	.48	.00	.00	2.40
Apply Ins Ground	5	.00	.00	.07	.42	.00	.62	.00	1.11
Cult + Post Early	5	1.02	.53	.29	.56	.55	1.15	.00	4.11
Cult + Post Early	6	1.02	.53	.29	.56	.55	2.26	.00	5.21
Hand Weed Control	6	.00	.00	.00	.00	6.16	.00	.00	6.16
Cult + Post Late	6	.77	.39	.22	.42	.41	3.31	.00	5.52
Cult + Post Late	6	.77	.39	.22	.42	.41	1.57	.00	3.78
Hand Weed Control	7	.00	.00	.00	.00	6.16	.00	.00	6.16

Table 2. Continued.

Operation Description	Month	---Tractor----		---Equipment--					
		Direct Cost	Fixed Cost	Direct Cost	Fixed Cost	Labor Cost	Material Cost	Misc. Cost	Total Cost
Cult + Post Late	7	.77	.39	.22	.42	.41	6.76	.00	8.98
Insect Scouting	7	.00	.00	.00	.00	.00	.00	1.50	1.50
Apply Ins Ground X 2	7	.00	.00	.85	.64	.35	4.91	.00	6.74
Apply Ins Air X 3	8	.00	.00	.00	.00	.07	10.99	2.40	13.46
Apply Ins Air X 2	9	.00	.00	.00	.00	.05	5.13	1.60	6.77
Defoliate - Air	9	.00	.00	.00	.00	.00	2.62	1.65	4.27
1st Pick 2 row	10	.00	.00	9.43	15.01	2.51	.00	.00	26.95
Haul	10	.00	.00	.00	.00	.00	.00	5.83	5.83
2nd Pick 2 row	10	.00	.00	4.80	7.64	1.28	.00	.00	13.71
Haul	10	.00	.00	.00	.00	.00	.00	1.46	1.46
Gin	10	.00	.00	.00	.00	.00	.00	51.44	51.44
Total Specified Costs		12.51	6.40	19.23	31.63	24.20	58.11	75.26	227.34
Interest on Operating Capital									5.24
Total Specified Costs Including Interest on Operating Capital									232.58

Table 3. Estimated cost per acre, solid cotton, clay soil, usual practices, 6 row equipment, Louisiana - Mississippi Delta, 1975.

Operation Description	Month	---Tractor---- Direct Cost	Fixed Cost	---Equipment-- Direct Cost	Fixed Cost	Labor Cost	Material Cost	Misc. Cost	Total Cost
Stalk Shredder 2 row	11	.99	.48	.05	.20	.69	.00	.00	2.41
Disk Harrow 21 ft	3	.60	.31	.34	.62	.32	.00	.00	2.19
Disk Harrow 21 ft	3	.60	.31	.34	.62	.32	.00	.00	2.19
Disk + Incor 21 ft	3	.77	.39	.56	.96	.41	6.10	.00	9.20
Field Cult 21 ft	4	.43	.22	.14	.31	.23	.00	.00	1.33
Disk Bed	4	.56	.28	.16	.27	.30	.00	.00	1.57
Rebed	4	.56	.28	.16	.27	.30	.00	.00	1.57
Apply Fert Spin Spr	4	.43	.22	.07	.12	.23	17.96	.00	19.03
Row Condition	5	.64	.33	.35	.67	.35	.00	.00	2.33
Plant + Pre	5	.85	.43	.42	.93	.91	15.82	.00	19.36
Trailer	5	.07	.03	.04	.08	.37	.00	.00	.59
Cultivate Early	5	.90	.46	.19	.37	.48	.00	.00	2.40
Apply Ins Ground	5	.00	.00	.45	.34	.18	.92	.00	1.89
Cult + Post Early	5	1.02	.53	.29	.56	.55	1.15	.00	4.11
Cult + Post Early	6	1.02	.53	.29	.56	.55	1.15	.00	4.11
Apply Fert Spin Spr	6	.43	.22	.07	.12	.23	17.96	.00	19.03
Hand Weed Control	6	.00	.00	.00	.00	9.20	.00	.00	9.20
Cult + Post Late	6	.77	.39	.22	.42	.41	.67	.00	2.89
Cult + Post Late	6	.77	.39	.22	.42	.41	.67	.00	2.89
Cultivate Late	7	.60	.31	.13	.25	.32	.00	.00	1.61

Table 3. Continued.

Operation Description	Month	---Tractor---- Direct Cost	Fixed Cost	---Equipment-- Direct Cost	Fixed Cost	Labor Cost	Material Cost	Misc. Cost	Total Cost
Hand Weed Control	7	.00	.00	.00	.00	6.90	.00	.00	6.90
Insect Scouting	7	.00	.00	.00	.00	.00	.00	1.50	1.50
Apply Ins Ground X 2	7	.00	.00	.90	.68	.37	7.33	.00	9.27
Apply Ins Air X 3	8	.00	.00	.00	.00	.07	10.99	2.40	13.46
Apply Ins Air X 2	9	.00	.00	.00	.00	.05	5.13	1.60	6.77
Defoliate - Air	9	.00	.00	.00	.00	.00	2.62	1.65	4.27
1st Pick 2 row	10	.00	.00	13.67	21.76	3.63	.00	.00	39.06
Haul	10	.00	.00	.00	.00	.00	.00	4.99	4.99
2nd Pick 2 row	10	.00	.00	7.15	11.37	1.90	.00	.00	20.42
Haul	10	.00	.00	.00	.00	.00	.00	1.25	1.25
Gin	10	.00	.00	.00	.00	.00	.00	44.00	44.00
Total Specified Costs		11.98	6.12	26.20	41.91	29.70	88.48	57.39	261.78
Interest on Operating Capital									5.97
Total Specified Costs Including Interest on Operating Capital									267.75

Table 4. Estimated cost per acre, soybeans, sandy soil, usual input practices, 6 row equipment, Louisiana - Mississippi Delta, 1975.

Operation Description	Month	---Tractor---- Direct Cost	Fixed Cost	---Equipment-- Direct Cost	Fixed Cost	Labor Cost	Material Cost	Misc. Cost	Total Cost
Chisel Plow 16 ft	3	.94	.48	.15	.33	.51	.00	.00	2.41
Chisel Plow 16 ft	3	.94	.48	.15	.33	.51	.00	.00	2.41
Disk + Incor 21 ft	4	.77	.39	.56	.96	.41	3.05	.00	6.15
Field Cult 21 ft	4	.43	.22	.14	.31	.23	.00	.00	1.33
Disk Bed	4	.56	.28	.16	.27	.30	.00	.00	1.57
Row Condition	5	.64	.33	.35	.67	.35	.00	.00	2.33
Plant	5	.66	.34	.30	.65	.71	11.02	.00	13.67
Trailer	5	.07	.03	.03	.07	.30	.00	.00	.50
Cultivate Early	6	.90	.46	.19	.37	.48	.00	.00	2.40
Cultivate Late	6	.60	.31	.13	.25	.32	.00	.00	1.61
Cult + Post Late	6	.77	.39	.22	.42	.41	1.98	.00	4.20
Cultivate Late	7	.60	.31	.13	.25	.32	.00	.00	1.61
Combine 20 ft	10	.00	.00	3.99	5.47	.53	.00	.00	9.99
Haul	10	.00	.00	.00	.00	.00	.00	1.76	1.76
Total Specified Costs		7.85	4.03	6.50	10.35	5.38	16.05	1.76	51.92
Interest on Operating Capital									1.49
Total Specified Costs Including Interest on Operating Capital									53.41

Table 5. Estimated cost per acre, soybeans, clay soil, usual input practices, 6 row equipment Louisiana - Mississippi Delta, 1975.

Operation Description	Month	---Tractor---- Direct Cost	Fixed Cost	---Equipment-- Direct Cost	Fixed Cost	Labor Cost	Material Cost	Misc. Cost	Total Cost
Disk Harrow 21 ft	3	.60	.31	.34	.62	.32	.00	.00	2.19
Disk + Incor 21 ft	4	.77	.39	.56	.96	.41	6.10	.00	9.20
Disk Harrow 21 ft	3	.60	.31	.34	.62	.32	.00	.00	2.19
Field Cult 21 ft	4	.43	.22	.14	.31	.23	.00	.00	1.33
Field Cult 21 ft	4	.43	.22	.14	.31	.23	.00	.00	1.33
Row Condition	5	.64	.33	.35	.67	.35	.00	.00	2.33
Plant	5	.66	.34	.30	.65	.71	11.02	.00	13.67
Trailer	5	.07	.03	.03	.07	.30	.00	.00	.50
Apply Herb Air	6	.00	.00	.00	.00	.00	3.24	1.50	4.74
Cultivate Early	6	.90	.46	.19	.37	.48	.00	.00	2.40
Cultivate Late	6	.60	.31	.13	.25	.32	.00	.00	1.61
Cult + Post Late	6	.77	.39	.22	.42	.41	1.98	.00	4.20
Cultivate Late	7	.60	.31	.13	.25	.32	.00	.00	1.61
Combine 20 ft	10	.00	.00	3.99	5.47	.53	.00	.00	9.99
Haul	10	.00	.00	.00	.00	.00	.00	1.84	1.84
Total Specified Costs		7.04	3.61	6.86	10.97	4.94	22.34	3.34	59.10
Interest on Operating Capital									1.78
Total Specified Costs Including Interest on Operating Capital									60.88

applications of insecticides. The operation entitled "Apply Ins Air X 2" is charged at a different rate per application because a different mix of insecticides is assumed to be applied. Total specified costs including interest on operating capital are estimated to be $279.38.

2x1 Cotton, Land Basis, Sandy Soil.--Table 2 lists 31 operations for 2x1 cotton[5/]. Total specified costs including interest on operating capital are estimated to be $232.58.

Solid Cotton, Clay Soil.--Table 3 lists the operations generally employed for the production of solid cotton on clay soil. Total specified costs including interest on operating capital are estimated to be $267.75.

Soybeans, Sandy Soil.--Table 4 lists 14 operations for soybeans on sandy soil. The most expensive operation is expected to be planting at $13.67. The second most expensive operation is expected to be combining. Total specified costs including interest on operating capital are $53.41 per acre.

Soybeans, Clay Soil.--Table 5 contains cost estimates for 15 operations for producing soybeans on clay soil. Specified costs including interest on operating capital total $60.88 per acre.

[5/] One land acre of 2x1 cotton will not protect a one acre cotton allotment.

Net Returns

Estimated costs and net returns per acre are summarized by income or expense item in Tables 6-10. For the three cotton budgets, total income reflects lint at $.40 per pound plus seed at $.05 per pound. Total direct expense applies to the items listed. Special equipment refers to self propelled equipment. Equipment refers to towed equipment. Special labor refers to operator time for self propelled equipment. Operator labor refers to tractor driver time. Common labor refers to all other labor. In these budgets, cotton pickers, combines and high clearance sprayers are the only self propelled equipment involved. Hauling and ginning are charged as direct expense items. Returns above direct expense were calculated by subtracting total direct expense from total income. Total specified expenses are the sum of total direct expense and total fixed expense. The last line entitled "Net Return" is calculated by subtracting total specified expenses from total income. Consequently, it should strictly be referred to as net returns above specified cost. However, it will be referred to as net returns for the balance of this publication and reflects net returns to management, land, and general farm overhead.

Solid Cotton, Sandy Soil.--With an assumed yield of 730 pounds of lint, solid cotton on sandy soil will generate the following economic values per acre in 1975: total income, $348.60; total direct expense,

Table 6. Estimated cost and net returns per acre, solid cotton, sandy soil, usual input practices, 6 row equipment, Louisiana - Mississippi Delta, 1975.

Item	Unit	Price	Quantity	Amount
		Dollars		Dollars
Income				
Cotton Lint	Lb	.40000	730.00	292.00
Cotton Seed	Lb	.05000	1132.00	56.60
Total Income				348.60
Direct Expense				
Common Labor	Hour	2.30	9.59	22.06
Operator Labor	Hour	2.30	3.08	7.08
Special Labor	Hour	2.30	1.44	3.32
Apply Lime X 1/4	Ton	12.50	.75	9.38
Treflan	Lb	6.10	.50	3.05
Fert Anhy Ammonia	Cwt	8.25	1.22	10.06
Karmex (DL)	Lb	5.07	.32	1.62
Temik	Lb	10.60	.30	3.18
Soil Treater XXX	Lb	.96	1.00	.96
Seed Triple Treated	Lb	.28	27.50	7.63
Bidrin	Lb	4.59	.20	.92
Msma + Surfactant	Lb	1.24	3.33	4.13
Cotoran	Lb	5.95	.80	4.76
Karmex (WP)	Lb	3.20	.20	.64
Lorox	Lb	6.76	1.00	6.76
Insect Scouting	Acre	1.50	1.00	1.50
Tox + Methyl Para	Pt	.96	18.69	17.94
Fundal	Lb	8.80	.63	5.50
Apply Ins Air	Acre	.80	5.00	4.00
Defoliant	Lb	1.83	1.43	2.62
Defoliate - Air	Acre	1.50	1.10	1.65
Special Equipment	Acre	22.17	1.00	22.17
Equipment	Acre	4.10	1.00	4.10
Tractor	Acre	12.83	1.00	12.83
Int On Op Cap	Acre	6.15	1.00	6.15
Haul	Lb	.01	730.00	8.29
Gin	Lb	.08	730.00	58.40
Total Direct Expense				230.68
Returns Above Direct Expenses				117.92
Fixed Expenses				
Special Equipment	Acre	34.15	1.00	34.15
Equipment	Acre	7.99	1.00	7.99
Tractor	Acre	6.56	1.00	6.56
Total Fixed Expense				48.70
Total Specified Expenses				279.38
Net Return				69.22

Table 7. Estimated cost and net returns per acre, 2x1 cotton, land basis, sandy soil, usual input practices, 6 row equipment, Louisiana - Mississippi Delta, 1975.

Item	Unit	Price	Quantity	Amount
		Dollars		Dollars
Income				
Cotton Lint	Lb	.40000	643.00	257.20
Cotton Seed	Lb	.05000	997.00	49.85
Total Income				307.05
Direct Expense				
Common Labor	Hour	2.30	6.50	14.94
Operator Labor	Hour	2.30	2.98	6.85
Special Labor	Hour	2.30	1.05	2.41
Apply Lime X 1/4	Ton	12.50	.75	9.38
Treflan	Lb	6.10	.50	3.05
Fert Anhy Ammonia	Cwt	8.25	.82	6.76
Karmex (DL)	Lb	5.07	.21	1.09
Temik	Lb	10.60	.20	2.13
Soil Treater XXX	Lb	.96	.67	.64
Seed Triple Treated	Lb	.28	18.50	5.13
Bidrin	Lb	4.59	.13	.62
Msma + Surfactant	Lb	1.24	1.47	1.82
Cotoran	Lb	5.95	.67	3.97
Msma	Lb	1.16	1.60	1.86
Karmex (WP)	Lb	3.20	.20	.64
Lorox	Lb	6.76	1.00	6.76
Insect Scouting	Acre	1.50	1.00	1.50
Tox + Methyl Para	Pt	.96	16.93	16.25
Fundal	Lb	8.80	.54	4.77
Apply Ins Air	Acre	.80	5.00	4.00
Defoliant	Lb	1.83	1.43	2.62
Defoliate - Air	Acre	1.50	1.10	1.65
Special Equipment	Acre	15.15	1.00	15.15
Equipment	Acre	4.08	1.00	4.08
Tractor	Acre	12.51	1.00	12.51
Int On Op Cap	Acre	5.24	1.00	5.24
Haul	Lb	.01	643.00	7.30
Gin	Lb	.08	643.00	51.44
Total Direct Expense				194.55
Returns Above Direct Expenses				112.50
Fixed Expenses				
Special Equipment	Acre	23.71	1.00	23.71
Equipment	Acre	7.92	1.00	7.92
Tractor	Acre	6.40	1.00	6.40
Total Fixed Expense				38.03
Total Specified Expenses				232.58
Net Return				74.47

Table 8. Estimated cost and net returns per acre, solid cotton, clay soil, usual practices, 6 row equipment, Louisiana - Mississippi Delta, 1975.

Item	Unit	Price	Quantity	Amount
		Dollars		Dollars
Income				
Cotton Lint	Lb	.40000	550.00	220.00
Cotton Seed	Lb	.05000	853.00	42.65
Total Income				262.65
Direct Expense				
Common Labor	Hour	2.30	8.59	19.76
Operator Labor	Hour	2.30	2.88	6.62
Special Labor	Hour	2.30	1.44	3.32
Treflan	Lb	6.10	1.00	6.10
Fert Amm Nitrate	Cwt	8.02	4.48	35.93
Karmex (DL)	Lb	5.07	.80	4.06
Temik	Lb	10.60	.30	3.18
Soil Treater XXX	Lb	.96	1.00	.96
Seed Triple Treated	Lb	.28	27.50	7.63
Bidrin	Lb	4.59	.20	.92
Msma + Surfactant	Lb	1.24	1.86	2.31
Karmex (WP)	Lb	3.20	.42	1.34
Insect Scouting	Acre	1.50	1.00	1.50
Tox + Methyl Para	Pt	.96	18.69	17.94
Fundal	Lb	8.80	.63	5.50
Apply Ins Air	Acre	.80	5.00	4.00
Defoliant	Lb	1.83	1.43	2.62
Defoliate - Air	Acre	1.50	1.10	1.65
Special Equipment	Acre	22.17	1.00	22.17
Equipment	Acre	4.04	1.00	4.04
Tractor	Acre	11.98	1.00	11.98
Int on Op Cap	Acre	5.97	1.00	5.97
Haul	Lb	.01	550.00	6.24
Gin	Lb	.08	550.00	44.00
Total Direct Expense				219.73
Returns Above Direct Expenses				42.92
Fixed Expenses				
Special Equipment	Acre	34.15	1.00	34.15
Equipment	Acre	7.75	1.00	7.75
Tractor	Acre	6.12	1.00	6.12
Total Fixed Expense				48.03
Total Specified Expenses				267.75
Net Return				-5.10

Table 9. Estimated cost and net returns per acre, soybeans, sandy soil, usual input practices, 6 row equipment, Louisiana - Mississippi Delta, 1975.

Item	Unit	Price	Quantity	Amount
		Dollars		Dollars
Income				
Soybeans	Bu	6.50000	22.00	143.00
Total Income				143.00
Direct Expense				
Common Labor	Hour	2.30	.26	.61
Operator Labor	Hour	2.30	1.84	4.24
Special Labor	Hour	2.30	.23	.53
Treflan	Lb	6.10	.50	3.05
Seed	Lb	.17	66.00	11.02
Dinitro	Lb	1.32	1.50	1.98
Special Equipment	Acre	3.99	1.00	3.99
Equipment	Acre	2.51	1.00	2.51
Tractor	Acre	7.85	1.00	7.85
Int on Op Cap	Acre	1.49	1.00	1.49
Haul	Bu	.08	22.00	1.76
Total Direct Expense				39.03
Returns Above Direct Expenses				103.97
Fixed Expenses				
Special Equipment	Acre	5.47	1.00	5.47
Equipment	Acre	4.88	1.00	4.88
Tractor	Acre	4.03	1.00	4.03
Total Fixed Expense				14.38
Total Specified Expenses				53.41
Net Return				89.59

Table 10. Estimated cost and net returns per acre, soybeans, clay soil, usual input practices, 6 row equipment, Louisiana - Mississippi Delta, 1975.

Item	Unit	Price	Quantity	Amount
		Dollars		Dollars
Income				
Soybeans	Bu	6.50000	23.00	149.50
Total Income				149.50
Direct Expense				
Common Labor	Hour	2.30	.26	.61
Operator Labor	Hour	2.30	1.65	3.80
Special Labor	Hour	2.30	.23	.53
Treflan	Lb	6.10	1.00	6.10
Seed	Lb	.17	66.00	11.02
Dyanap	Pt	.81	4.00	3.24
Apply Herb Air	Acre	1.50	1.00	1.50
Dinitro	Lb	1.32	1.50	1.98
Special Equipment	Acre	3.99	1.00	3.99
Equipment	Acre	2.87	1.00	2.87
Tractor	Acre	7.04	1.00	7.04
Int on Op Cap	Acre	1.78	1.00	1.78
Haul	Bu	.08	23.00	1.84
Total Direct Expense				46.30
Returns Above Direct Expenses				103.20
Fixed Expenses				
Special Equipment	Acre	5.47	1.00	5.47
Equipment	Acre	5.50	1.00	5.50
Tractor	Acre	3.61	1.00	3.61
Total Fixed Expense				14.58
Total Specified Expenses				60.88
Net Return				88.62

$230.68; total fixed expense, $48.70[6]; total specified expense, $279.38; and net return, $69.22.

2x1 Cotton, Land Basis, Sandy Soil.--Table 7 reports the estimated cost and net returns per acre for 2x1 cotton, land basis, sandy soil. Total income and direct expense are estimated at $307.05 and $194.55 per acre, respectively. Returns above direct expense are expected to be $112.50 per acre. Deducting fixed expense of $38.03 per acre results in an estimated net return of $74.47 per acre.

Solid Cotton, Clay Soil.--Table 8 reports estimated cost and net returns per acre for solid cotton on clay soil. Total income is estimated to be $262.65, total direct expense is $219.73, and total fixed expense is $48.03. Estimated returns above direct expenses are $42.92 per acre and net return is a negative $5.10 per acre.

Soybeans, Sandy Soil.--Table 9 lists estimated cost and net returns per acre for soybeans on sandy soil. The assumed yield of 22 bushels per acre at $6.50 per bushel implies a total income of $143.00. Cost and return estimates per acre for 1975 include: total direct expense, $39.03; total fixed expense, $14.38; total specified expenses, $53.41; returns above direct expense, $103.97; and net return, $89.59.

---

[6] This figure is appropriate for all new tractors and equipment purchased in 1975 and overestimates fixed expense per acre for producers utilizing tractors and/or equipment purchased prior to 1975.

Soybeans, Clay Soil.--An assumed yield of 23 bushels results in an estimated total income of $149.50 for soybeans on clay soil in 1975 (Table 10). Total direct and fixed expenses per acre are $46.30 and $14.58, respectively. Estimated returns per acre are $103.20 above direct expenses and $88.62 above direct and fixed costs.

DISCUSSION

Information presented in Tables 1-10 is summarized in Table 11. Special attention is directed to the columns entitled "Returns Above Direct Expenses" and "Returns Above Specified Expenses". As noted previously (see Footnote 6) these estimates of "Total Fixed Expense" reflects new tractors and equipment purchased in 1975. Most producers will not purchase completely new tractor and equipment bundles in 1975. Consequently, total fixed expense as reported is over estimated[7/] for most producers for the 1975 crop year. Total fixed expense as reported will apply only for individuals purchasing completely new sets of tractors and equipment in 1975.

Farmers who have been producing cotton and/or soybeans for the last several years and have adequate equipment packages on hand may choose to make their 1975 planting decisions based on returns above direct expenses.[8/] This would be a one-year short run decision. In the long run, decisions must ultimately be based upon returns above total expenses.[9/] Largest returns above direct expenses are expected for solid cotton on sandy soil. Estimated returns per acre above direct expenses for the various crop activities considered in this publication

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[7/] The magnitude of the over estimation will depend upon a given producer's particular mix of equipment (i.e., its age distribution).

[8/] Such a decision would be consistent with short run economic theory.

[9/] Total expenses include both direct and fixed expenses plus other expenses such as land and general farm overhead.

Table 11. Selected budget information, cotton and soybeans, Mississippi Delta, 1975.

	Yield	Unit	Price Per Unit	Total Income	Total Direct Expense	Returns Above Direct Expense	Total Fixed Expense	Total Specified Expense	Returns Above Specified Expense
			dollars	dollars/acre					
Solid Cotton, Sandy Soil	730 1132	Lb. Lint Lb. Seed	.40 .05	348.60	230.68	117.92	48.70	279.38	69.22
2x1 Cotton, Sandy Soil	643 997	Lb. Lint Lb. Seed	.40 .05	307.05	194.55	112.50	38.03	232.58	74.47
Solid Cotton, Clay Soil	550 853	Lb. Lint Lb. Seed	.40 .05	262.65	219.73	42.92	48.03	267.75	-5.10
Soybeans, Sandy Soil	22	Bu.	6.50	143.00	39.03	103.97	14.38	53.41	89.59
Soybeans, Clay Soil	23	Bu.	6.50	149.50	46.30	103.20	14.58	60.88	88.62

are as follows: solid cotton, sandy soil, $117.92; 2x1 cotton, sandy soil, $112.50; soybeans, sandy soil, $103.97; soybeans, clay soil, $103.20; and solid cotton, clay soil, $42.92.

The relative profitability is somewhat changed when returns above specified expense (direct and fixed) are examined. Net returns per acre for the various crops are estimated as follows: soybeans, sandy soil, $89.59; soybeans, clay soil, $88.62; 2x1 cotton, sandy soil, $74.47; solid cotton, sandy soil, $69.22; and solid cotton, clay soil, -$5.10.

CONCLUSION

The returns to be expected from the production of cotton and soybeans are related to production costs, yield, and prices received. This manuscript presents projected costs for the 1975 crop year. Producers are encouraged to use their own historical yield and their own "notion" on price to calculate their particular estimates of returns.[10/] Producers are cautioned to consider their own unique production limitations (i.e., labor, equipment, etc.) before deciding on producing a single crop of either cotton or soybeans.

One conclusion follows from the information presented. Unless production costs decline considerably, cotton prices increase substantially, or yields per acre increase, cotton production on clay soils is likely to approach zero in the long run for the usual producer in the Delta.

[10/] Estimates of 1975 production costs for other size equipment (tractor and/or row size) and/or level of technology may be obtained by contacting the authors. Other publications are in process which present more detailed production cost information for cotton, soybeans and other crops.

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GRAIN SORGHUM MARKETING IN MISSISSIPPI WITH POTENTIAL MARKETING ALTERNATIVES

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Summary

Grain sorghum production has been sought as a solution to the feed grain deficiency in Mississippi and as a crop for land not suited to the production of cotton and soybeans. Grain sorghum is drought resistant, it can be planted relatively late and relatively small variable costs usually are required for producing it on land that would otherwise remain idle. Also, the crop fits well into the program of many feeders who own drying and storage facilities. Despite these advantages, the crop has contributed only slightly to eliminating the feed grain deficiency in the state. Production increased from 297 thousand bushels in 1965 to 5.4 million bushels in 1971 but fell to only slightly more than one million bushels in 1973.

While there are problems with production---for example, low yields because of late planting---and with feeding---for example, variation in feeding value from batch to batch---, many of the more serious problems are found in the market. Normally, grain sorghum is harvested at about the same time as soybeans and it usually requires drying. Elevators generally are not equipped to dry it. Feed mills usually have storage facilities for only two or three days supply of grain and do not have drying facilities. Thus, unless farmers have drying and storage facilities, grain sorghum often becomes distress merchandise.

Mississippi producers generally have received a price well below the cost of shipped-in grain and the net value of the crop when shipped from the State. In terms of the relative feed value of the two crops, grain sorghum for the 1968-72 period was lower priced than corn.

We analyzed the potential of on-farm drying and storage for improving the market for grain sorghum produced in Mississippi. Costs of on-farm drying in a 500-bushel capacity drier used to dry 20,000 bushels annually and costs of storing in a 4,400-bushel capacity metal bin were computed. Drying charges at commercial elevators were computed from a moisture discount schedule and estimates of storage charges were made with reference to the 1971 Uniform Grain Storage Agreement.

On-farm drying of grain sorghum in Mississippi appears to be less costly than commercial drying. Since the on-farm storage cost of grain sorghum is an estimated 12.0 cents per bushel per year a the commercial rate is 1.5 cents bushel per month plus the sev cent in-and-out charge, the farn who does not already ha available on-farm storage and w plans to store grain no longer th three to four months may find co mercial storage cheaper. On-fa storage appears to be cheaper periods of storage longer than t or if the storage space may be us for storing other grains at differ times of the year.

If a producer already owns fa storage facilities, he will incur proximately an eight cent bushel fixed cost regardless whether he stores---for depre tion, interest on investment, surance and taxes. Thus, once investment is made in facilities, only costs entering the stor decision are the variable costs putting grain into storage, hold it in storage and removing it fr storage. Although our estimate farm storage costs allow average quantity and qua losses, the producer who st grain bears the full risk of s losses. Much of this risk can passed to the elevator by us commercial storage.

Grain Sorghum Marketing in Mississippi With Potential Marketing Alternatives

Production of feed grains in Mis-
sippi has decreased while feed
ain requirements have steadily
creased. Corn production has de-
ned as relatively more profitable
tton and soybeans have taken its
ice. Grain sorghum production
s been sought as a solution to the
d grain deficiency and as a crop
land not suited to the produc-
n of cotton and soybeans.

Many problems confront brown
rd resistant) grain sorghum
oduction in Mississippi. First,
hough research indicates that
h yields (in the range of 75-90
shels per acre or more) are possi-
, grain sorghum in Mississippi
seldom produced under optimum
iditions and generally is planted
reral weeks too late. Second,
in sorghum is harvested at ap-
ximately the same time as soybeans. Usually it must be dried and elevators generally are not equipped to dry it. Feed mills usually have storage facilities for only two or three days' supply of grain and do not have drying facilities. Thus, unless farmers have drying and storage facilities, grain sorghum often becomes distress merchandise. Third, the feed value of grain sorghum varies widely from batch to batch. Feeding value ranges from 90 to 100 percent of that of corn, depending upon how it was produced and the animals to which it is fed.

Even if these problems are not solved, some grain sorghum production will likely continue rather than letting land lie fallow after it becomes too late to plant cotton or soybeans. Often, only small variable costs are required for producing grain sorghum on land that would otherwise remain idle. An economic evaluation of the problems associated with grain sorghum marketing and of some possible alternatives is needed to provide guidance for orderly marketing of future production.

The purpose of this bulletin is to describe how grain sorghum moved through the Mississippi marketing system in 1970, to ascertain if the prices received for grain sorghum in Mississippi have been representative of the grain's value, and to describe alternative marketing methods that could give farmers more nearly the crop's value.

For the purposes of the report, the state was delineated into three substate areas referred to as the Delta, northeast, and south (Figure 1).

Production, Marketing and Utilization

'roduction---Grain sorghum
duction in Mississippi in-
ised from 297 thousand bushels
1965 to 5.4 million bushels in
1 (Table 1). But in 1973 produc-
ı fell to only slightly more than
million bushels.

he northeastern part of the
e has for several years been the
ior grain sorghum producing
a, and since 1970 production in
southern area has sharply out-
ipped that in the Delta.
hough yields in the Delta have
raged somewhat higher than in
er of the other areas, the rate of
age cutback has been sharpest
e.

Marketing---In recent years more than one half of the grain sorghum produced in Mississippi has been sold from the farm where it was produced (Table 2).

As measured by local purchases of grain sorghum by grain handlers in 1970, only the Delta is primarily a cash grain area (Tables 1 and 3).[1] Delta handlers appeared to purchase most, if not all, of the grain sorghum produced in the area, plus some from outside the area. Nebraska was the primary source of grain sorghum from out-of-state (Table 4). Intrastate movements were primarily by truck, while rail was used primarily for out-of-state purchases (Tables 4 and 5). Purchases from out-of-state were heaviest during winter months.

Even though Mississippi was a net importer of grain sorghum in 1970, nearly a million bushels were shipped from the State (Table 6.). Most of the out-of-state shipment was to adjacent states, with a small quantity reported as shipped for export.

Most of the almost 2.5 million bushels purchased by grain handlers directly from farmers was acquired by elevators (Tables 3 and 7). About one half of the purchases by elevators went to feed mills and

---

*[1] Data on 1970 purchases and sales of grain by grain handling firms were obtained by personal inter-
ews of firm operators as part of a broader grain marketing study.*

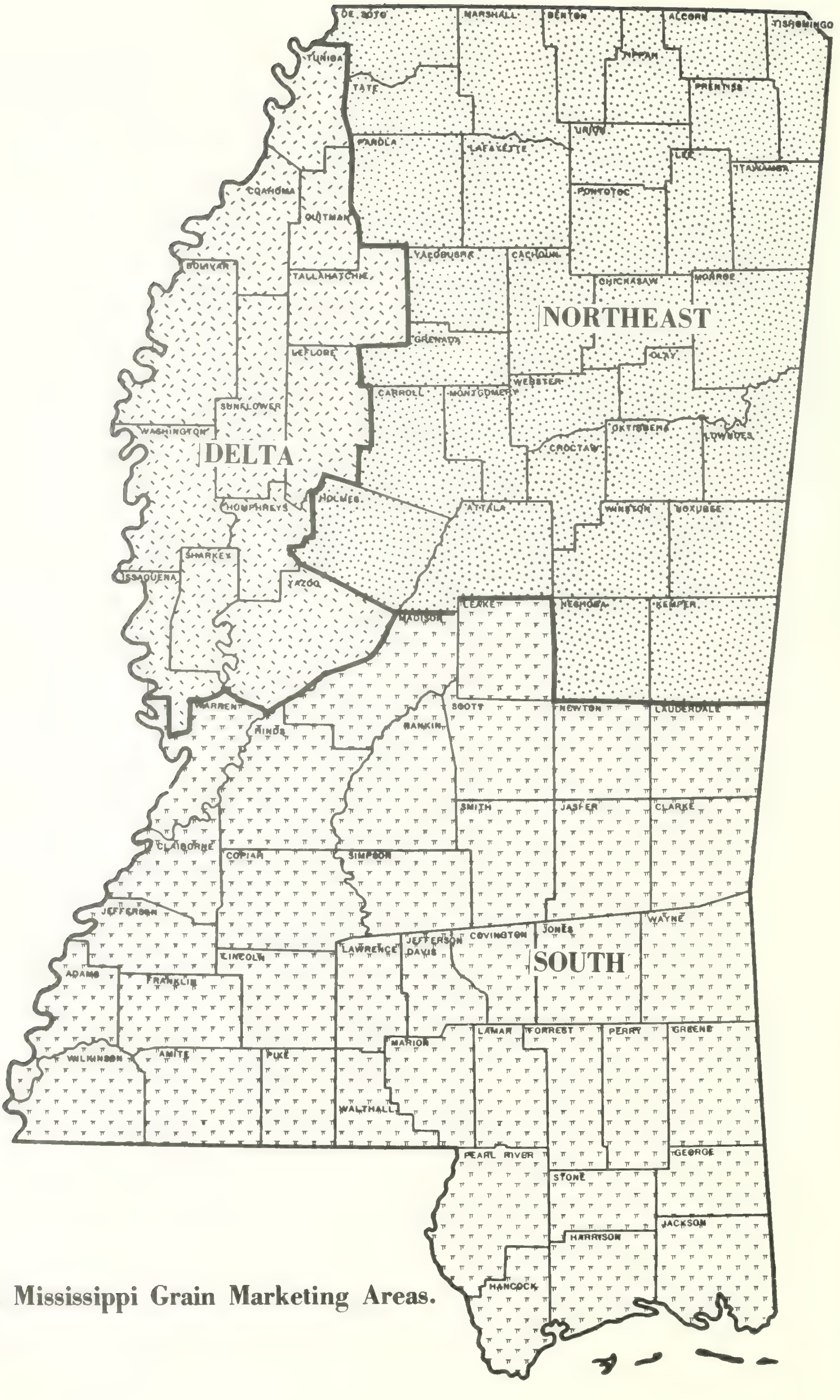
DE SOTO
MARSHALL
BENTON
ALCORN
TISHOMINGO
TUNICA
TATE
TIPPAH
PRENTISS
UNION
PANOLA
LAFAYETTE
LEE
ITAWAMBA
COAHOMA
PONTOTOC
QUITMAN
YALOBUSHA
CALHOUN
BOLIVAR
TALLAHATCHIE
CHICKASAW
MONROE
NORTHEAST
GRENADA
LEFLORE
CLAY
WEBSTER
CARROLL
MONTGOMERY
SUNFLOWER
OKTIBBEHA
WASHINGTON
LOWNDES
DELTA
CHOCTAW
HOLMES
HUMPHREYS
ATTALA
WINSTON
NOXUBEE
SHARKEY
ISSAQUENA
YAZOO
LEAKE
NESHOBA
KEMPER
MADISON
WARREN
SCOTT
NEWTON
LAUDERDALE
HINDS
RANKIN
SMITH
JASPER
CLARKE
CLAIBORNE
COPIAH
SIMPSON
JEFFERSON
WAYNE
JONES
COVINGTON
JEFFERSON DAVIS
LAWRENCE
SOUTH
LINCOLN
ADAMS
FRANKLIN
LAMAR
FORREST
PERRY
GREENE
MARION
WILKINSON
AMITE
PIKE
WALTHALL
PEARL RIVER
GEORGE
STONE
JACKSON
HARRISON
HANCOCK

Figure 1. Mississippi Grain Marketing Areas.

e remainder was sold to local eders or shipped from the state. urchases from out-of-state were feed mills.

Utilization--The use of grain sorghum in Mississippi in 1970 was estimated by using net flows, production and changes in stocks (Table 8). An estimated 4.3 million bushels were used, with almost 60 percent of total disappearances occurring in the southern area. Most of the remainder was fed in the northeastern area.

le 1. Sorghum for grain: Harvested acreage, yield, and production, by substate areas, Mississippi, 5-1973.

ar	Acreage				Yield				Production			
	Delta	North-east	South	State	Delta	North-east	South	State	Delta	North-east	South	State
	--------(1,000 acres)--------				--------(bushels)--------				--------(1,000 bushels)--------			
5	4	3	2	9	35	31	32	33	145	105	47	297
6	7	3	2	12	45	41	38	43	329	127	60	516
7	3	5	2	10	42	39	38	40	129	205	66	400
8	6	13	7	26	45	43	42	43	261	579	278	1,118
9	10	12	9	31	43	42	30	39	433	502	274	1,209
0	30	57	29	116	45	47	41	45	1,355	2,658	1,207	5,220
	30	79	41	150	40	34	36	36	1,222	2,722	1,456	5,400
2	5	15	13	33	56	40	41	43	288	590	541	1,419
3	4	14	12	30	53	31	33	35	213	437	400	1,050

rce: State totals and, where possible, substate totals were obtained from USDA, Crop and estock Reporting Service.

le 2. Production, use, and price of grain sorghum, Mississippi, 1964-1973.

Crop Year	Production	Feed & Seed on Farm Where Grown	Sold		Seasonal Average Price
			Quantity	Percent of Production	
	----------------(1,000 bu.)----------------			-Percent-	-Cents-
4	266	160	106	40	109
5	297	178	119	40	103
6	516	268	248	48	115
7	400	212	188	47	105
8	1,118	447	671	60	96
9	1,209	459	750	62	112
0	5,220	1,827	3,393	65	128
	5,400	1,782	3,618	67	93
2	1,419	525	894	63	124
3	1,050	420	630	60	216

rce: USDA Crop Reporting Board, *Field Crops: Production, Farm Use, Sales, and Value.*

Table 3. Estimated quantities of grain sorghum purchased by Mississippi grain handlers, by sourc supply, by month, 1970.

	Location of Handlers and Sources of Supply											
	Delta			Northeast			South			State		
Month	Local	Out-of-state	Total	Local	Out-of-state	Total	Local	Out-of-state	Total	Local	Out-of-state	Tc
					(1,000 bu.)							
Jan.				18	7	25	5	240	245	23	247	
Feb.				17	7	24	7	244	251	24	251	
March				18	8	26		242	242	18	250	
April				18	6	24	2	133	135	20	139	
May				24	8	32		132	132	24	140	
June				31	7	38		133	133	31	140	
July				25	6	31		133	133	25	139	
Aug.	37		37	24	7	31	109	66	175	170	73	
Sept.	1,177		1,177	24	6	30	219	68	287	1,420	74	1,
Oct.	437		437	28	7	35	57	119	166	512	126	
Nov.	37		37	40	8	48	10	179	189	87	187	
Dec.	3		3	33	8	41	37	201	238	73	209	
Total	1,691		1,691	300	85	385	436	1,890	2,326	2,427	1,975	4,

Table 4. Grain sorghum purchases in Mississippi, by source of supply and by mode of transporta and destination area, 1970.

Mode of Transportation and Destination Area	Source of Supply								
	Mississippi								
	Local	Delta	North-east	South	La.	Nebr.	Kans.	Total	Net shipr
				(1,000 bu.)					
Rail									
Delta									
Northeast		112				54		166	
South				214		1,371	461	2,046	1,8
Total		112		214		1,425	461	2,212	1,8
Truck									
Delta	1,691							1,691	
Northeast	300	12	253			9	22	596	
South	436	609	104	33	58			1,240	
Total	2,427	621	357	33	58	9	22	3,527	
All Modes									
Delta	1,691							1,691	
Northeast	300	124	253			63	22	762	
South	436	609	104	247	58	1,371	461	3,286	1,8
Total Purchases	2,427	733	357	247	58	1,434	483	5,739	1,9

ble 5. Monthly purchases of ain sorghum from out-of- ate sources, by mode of nsportation, by month, Mississippi, 1970.

nth	Truck	Rail	Total
	----(1,000	bu.)----	
uary	3	244	247
ruary	5	246	251
rch	3	247	250
il	1	138	139
y	3	137	140
e	3	137	140
y	2	137	139
gust	2	71	73
tember	2	72	74
ober	11	115	126
ember	27	160	187
ember	27	182	209
otal	89	1,886	1,975

Intrastate movements of grain sorghum purchases were primarily by truck, while rail was used primarily for out-of-state purchases. Purchases from out-of-state were heaviest during winter months.

le 6. Grain sorghum shipments in Mississippi, by mode of transportation and area of origin, and by ination area, 1970.

Mode of nsportation and Area of Origin	Destination Area									Net Out-shipments
	Mississippi						Other	Gulf		
	Local	Delta	North-east	South	N. Ala.	S. Ala.	Southern States	For Export	Total	
	----------(1,000 bu.)----------									
ta		7	35	358	514		22		936	536
rtheast										0
th			45	184		109	14		352	123
tal		7	80	542	514	109	36		1,288	659
k										
ta	20	27	294	1	29	29		147	547	205
theast	11							14	25	14
th	5			300					305	0
tal	36	27	294	301	29	29		161	877	219
Modes										
a	20	34	329	359	543	29	22	147	1,483	741
theast	11							14	25	14
th	5		45	484		109	14		657	123
Shipments	36	34	374	843	543	138	36	161	2,165	878

Table 7. Grain sorghum purchases in Mississippi by source of supply and by primary type of firm, 1970.

	Type of Firm		
Source of Supply	Elevators*	Feed Mills	Total
	----------(1,000 bu.)----------		
Local	2,035	392	2,427
Intra-state	300	1,037	1,337
Out-of-state	0	1,975	1,975
Total	2,335	3,404	5,739

*Includes a small quantity purchased and resold by oil mills.

Table 8. Estimates of grain sorghum utilization, by substate areas, Mississippi, 1970.

Item	Delta	Northeast	South	State
Net inshipments	0	85	1,890	1,975
Net outshipments	741	14	123	878
Net flows	-741	71	1,767	1,097
Jan. 1, 1970 stocks	253	495	223	971
Production 1970	1,355	2,658	1,207	5,220
Available 1970	867	3,224	3,197	7,288
Jan. 1, 1971 stocks *	779	1,529	689	2,997
Utilization	88	1,695	2,508	4,291

*Stocks were allocated to substate areas by applying each area's percentage of 1970 production to the total stocks in Mississippi in each year.

Pricing Efficiency

We analyzed prices[2] of grain sorghum for the five year period, 1968-1972[3], to determine whether receipts of Mississippi farmers were equal to the value of the grain they sold. Indianola, Tupelo and Jackson were selected as representative of the Delta, northeastern and southern regions, respectively, and two measures were used to determine the efficiency of pricing grain sorghum in Mississippi:

1. Limits within which prices received by Mississippi farmers were expected to lie were derived.
2. Corn and grain sorghum price-feed value ratios were compared.

Theoretical Price Ranges---If the market is efficient, prices paid for grain sorghum shipped to areas in Mississippi from a major supplying source will be equal to the price at the supply source plus transpo tation and handling costs and th prices paid by local purchasers f grain sorghum supplied by farme in Mississippi will be equal to less than the price paid for shippe in grain sorghum, but not more. the same time, prices received local farmers will not fall below th prices at possible receivin markets minus the transfer cos from the production area to t ceiving markets. If prices receiv- d by farmers from local ırchasers are less than the prices aid at other markets minus the ansfer costs, it will be to the ırmers' advantage to sell the ain in the other markets.

---

[2] *Except for the prices received by Mississippi farmers, we used prices of yellow sorghum. (We assumed, however, that the prices received and feed value of brown sorghum are equal to those of yellow sorghum. Brown sorghum alone is not exported. Apparently, however, small quantities of the brown can be blended with the yellow for export.)*

[3] *The crop year for grain sorghum begins with August and goes through the following July.*

Thus, there is a theoretical upper ıd lower price limit for grain rghum sold in a given area. If ef- cient marketing procedures are ırried out, the prices received for ıe grain should be equal to or ithin the theoretically establish- l price limits.

To determine if the prices receiv- l for grain sorghum by Mississip- farmers in 1968-72 fell within the ıeoretical price limits, prices ceived by them were compared th the costs of procuring grain om the two major supplying arkets---Kansas City and Fort orth---and with the net proceeds om selling in New Orleans. ansfer costs between these arkets and the points selected in ississippi were composed of ansportation charges and related andling and merchandising sts. "Published Barge Rates on lk Grain," issued by the Arrow ansportation Company, was ed for determining the cost of ater transportation (Appendix able 1.). In two instances, the rge rates had to be interpolated ıe to lack of data.

Truck rates (Appendix Table 2.) ere computed from the function):[4]

$$C = 4.6 + 3.2X$$

here

C = rate in cents per bushel and

X = distance in 100 miles.

stances used represented the ortest routes over major ghways (Appendix Table 3.). The l rates were provided by the nnessee Valley Authority (Appendix Table 4.). Transportation costs for each mode of transportation between selected markets are presented in Appendix Table 5.

Charges of 2.5 cents per bushel for receiving the grain, 2.5 cents per bushel for loading it out, and one cent per bushel for merchandising were added to the grain sorghum being shipped to New Orleans by Mississippi farmers, since it was assumed that the farmers would ship through an elevator. An additional two cents per bushel for loading the grain on the vessel were added to the grain sorghum shipped to New Orleans, since the prices quoted were f.o.b. vessel.

Minimum procurement costs of grain sorghum were derived by adding the computed transfer charges to the cost of the grain at the Kansas City[5] and Fort Worth markets (Table 9 and Appendix Table 6.). Kansas City was the optimal source of the two for all three Mississippi areas for all but two months of the five-year period. Although the transportation rate from Fort Worth was lower in most cases, the initial cost of the grain sorghum was usually higher than the cost at Kansas City. The survey data obtained for 1970 revealed that no grain sorghum was shipped to Mississippi from the Fort Worth area.

The average cost of procuring grain sorghum from Kansas City was higher than the average price paid to Mississippi farmers during 1968-72 (Tables 9 and 10.). This spread was substantially larger in 1971 and 1972 than in the earlier years.

Prices received by Mississippi farmers during 1968-70 averaged slightly less than the net prices for grain delivered to New Orleans (Tables 10 and 11.). However, in 1971 and 1972 Mississippi producers received considerably less than the net New Orleans prices. Obviously, farmers who sold to local purchasers in the latter two years failed to realize the advantage of selling in an alternative market.

Price-Feed Value Ratios--- Although a bushel of corn and a bushel of grain sorghum each weigh 56 pounds, the relative feeding value of corn and grain sorghum for different animals varies (6). For feeding dairy animals or for wintering beef cattle, the two grains are of equal feed value. But for poultry, the feeding value of grain sorghum is only 95 percent of that of corn. For fattening beef cattle, grain sorghum is only 92 percent, and for feeding hogs only 90 percent as efficient as corn. Thus, for the first two uses, grain sorghum is a better buy than corn if its price is lower by any amount than that of corn. But for use as poultry feed, grain sorghum is the better buy only if its price is less than 95 percent of corn. Similarly, grain sorghum must be priced at less than 92 percent and 90 percent of the price of corn for it to be the more economical feed for beef cattle and hogs, respectively.

Grain sorghum prices in Mississippi averaged 15 to 16 cents per bushel less than corn prices over the 5-year period, with a price difference as high as 45 cents in some months in some areas (Appendix Table 7.). Over the five years, grain sorghum prices were, on average, 89 percent of corn prices in the Delta and the south and 91 percent in the northeast (Tables 12-14). In all areas, grain sorghum prices were below corn prices by the greatest amount during the harvest period.

The average price of corn

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[4] *Numbers in parentheses refer to items listed in Bibliography*

[5] *The cheapest mode of transportation from Kansas City in all cases was rail. Only 4 percent of the grain sorghum shipped to Mississippi from Kansas City was by truck.*

relative to that of grain sorghum during 1968-72 was such that grain sorghum would have been the better feed buy for the major livestock groups. Assuming that the price of corn reflected its feed value, grain sorghum was und priced in Mississippi during th five-year period.

Table 9. Estimated procurement cost of grain sorghum at Jackson, Tupelo, and Indianola, Mississippi, by source of supply, by months, 1968-1972.*

Year	Jackson		Tupelo		Indianola	
and Month	Fort Worth	Kansas City	Fort Worth	Kansas City	Fort Worth	Kansas City
	----------(cents per bushel)----------					
1968						
Aug.	138	**115**	142	**113**	138	**115**
Sept.	137	**116**	141	**113**	136	**116**
Oct.	141	**118**	146	**117**	141	**118**
Nov.	145	**124**	150	**122**	145	**123**
Dec.	145	**122**	150	**121**	145	**122**
Jan.	146	**125**	151	**123**	146	**125**
Feb.	146	**125**	151	**123**	146	**125**
Mar.	145	**124**	150	**122**	145	**124**
Apr.	146	**126**	151	**125**	146	**126**
May	148	**129**	153	**127**	148	**128**
June	151	**130**	156	**128**	151	**130**
July	155	**132**	160	**130**	155	**132**
1969						
Aug.	156	**134**	160	**132**	155	**134**
Sept.	157	**133**	162	**131**	157	**133**
Oct.	159	**133**	164	**131**	159	**133**
Nov.	153	**132**	158	**130**	153	**132**
Dec.	156	**131**	161	**130**	156	**131**
Jan.	157	**132**	161	**131**	157	**132**
Feb.	156	**131**	160	**129**	155	**131**
Mar.	156	**126**	160	**125**	155	**126**
Apr.	151	**128**	155	**127**	150	**128**
May	149	**126**	154	**125**	149	**126**
June	149	**130**	154	**128**	149	**130**
July	153	**136**	158	**133**	153	**135**
1970						
Aug.	154	**141**	159	**139**	154	**140**
Sept.	163	**147**	168	**145**	163	**147**
Oct.	162	**143**	167	**141**	162	**143**
Nov.	161	**137**	166	**135**	161	**137**
Dec.	163	**147**	168	**145**	163	**147**
Jan.	167	**153**	172	**151**	167	**153**
Feb.	171	**152**	176	**150**	171	**152**
Mar.	171	**150**	175	**148**	170	**150**
Apr.	180	**156**	185	**153**	180	**155**
May	185	**158**	190	**156**	185	**158**
June	190	**165**	195	**163**	190	**165**
July	184	**162**	189	**160**	184	**162**

(continued)

Table 9. Estimated procurement cost of grain sorghum at Jackson, Tupelo, and Indianola, Mississippi, by source of supply, by months, 1968-1972.* (continued)

Year	Jackson		Tupelo		Indianola	
and Month	Fort Worth	Kansas City	Fort Worth	Kansas City	Fort Worth	Kansas City
	----------(cents per bushel)----------					
1971						
Aug.	173	**147**	178	**144**	173	**146**
Sept.	154	**121**	159	**119**	154	**121**
Oct.	150	**121**	155	**119**	150	**121**
Nov.	154	**128**	159	**126**	154	**127**
Dec.	161	**136**	166	**134**	161	**136**
Jan.	161	**136**	168	**134**	161	**136**
Feb.	159	**136**	164	**134**	158	**136**
Mar.	158	**136**	163	**134**	158	**136**
Apr.	159	**138**	164	**136**	159	**137**
May	159	**137**	164	**135**	159	**137**
June	139	**138**	144	**136**	139	**137**
July	141	**139**	146	**137**	141	**139**
1972						
Aug.	143	**135**	147	**133**	143	**135**
Sept.	147	**144**	151	**142**	146	**144**
Oct.	145	**142**	150	**140**	145	**142**
Nov.	158	**156**	163	**154**	158	**156**
Dec.	186	**182**	191	**180**	186	**182**
Jan.	**189**	192	194	**190**	**189**	192
Feb.	186	**182**	191	**180**	186	**182**
Mar.	188	**181**	193	**179**	188	**181**
Apr.	184	**179**	189	**177**	184	**179**
May	198	**194**	203	**192**	198	**194**
June	225	**223**	230	**221**	225	**223**
July	**238**	239	243	**237**	**238**	239

***All costs are based on the cheapest mode of transportation. The procurement costs in bold type indicate the cheapest source and mode of grain sorghum each month.**

Source: Appendix Tables 1 and 6.

10. Average of prices received by farmers for grain sorghum in Mississippi, by month, 1968-

'ear ıing	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July
	----------(cents per bushel)----------											
	a	95	95	95	95	98	98	104	106	106	106	106
	106	106	106	112	123	112	118	120	120	123	123	123
	112	123	123	129	129	134	134	134	134	134	140	137
	132	101	90	84	90	90	90	95	98	98	95	101
	a	106	112	123	143	146	146	143	140	148	a	129

a not available.

: Agricultural Prices, Crop Reporting Board, Statistical Reporting Service, U. S. Department iculture.

Table 11. Prices of grain sorghum at New Orleans (export) minus transfer charges from Jackson, Tupelo, and Indianola, by month, 1968-1972.*

Year and Month	Jackson	Tupelo	Indianola
	----------(cents per bushel)----------		
1968			
August	96	91	93
September	100	95	97
October	107	102	104
November	111	106	108
December	109	102	106
January	112	107	109
February	117	**108**	**110**
March	110	105	107
April	111	106	108
May	**114**	109	111
June	106	111	103
July	109	104	106
1969			
August	116	111	113
September	118	113	115
October	**122**	**117**	**119**
November	120	115	117
December	118	113	115
January	119	114	116
February	119	114	116
March	114	109	111
April	113	108	110
May	113	108	110
June	112	107	109
July	112	107	109
1970			
August	118	113	115
September	133	128	130
October	132	127	129
November	129	124	126
December	133	128	130
January	137	132	134
February	140	135	137
March	137	132	134
April	141	136	138
May	144	139	141
June	**148**	**143**	**145**
July	135	130	132

(continued)

Table 11. Prices of grain sorghum at New Orleans (export) minus transfer charges from Jackson, Tupelo, and Indianola, by month, 1968-1972.* (continued)

Year and Month	Jackson	Tupelo	Indianola
	----------(cents per bushel)----------		
1971			
August	121	116	118
September	112	107	109
October	111	106	108
November	117	112	114
December	**126**	**121**	**123**
January	124	119	121
February	125	120	122
March	125	120	122
April	126	121	**123**
May	120	115	117
June	116	111	113
July	121	116	118
1972			
August	128	123	125
September	137	132	134
October	134	129	131
November	136	141	133
December	183	178	180
January	196	191	193
February	188	183	185
March	183	178	180
April	178	173	175
May	185	180	182
June	211	206	208
July	**246**	**241**	**243**

***Prices in bold type indicate the highest prices in each year after transfer charges were subtracted.**

Table 12. Grain sorghum price as a percentage of the price of corn in the Delta of Mississippi, by month, 1968-1972.

		----------Year----------			
Month	**1968**	**1969**	**1970**	**1971**	**1972**
		----------Percent----------			
August	88	84	72	82	89
September	84	82	76	75	82
October	87	88	80	81	89
November	91	94	85	89	90
December	88	93	84	89	93
January	89	91	84	92	91
February	93	93	85	92	93
March	92	93	87	93	95
April	94	91	90	93	92
May	92	89	91	92	85
June	91	89	90	93	84
July	91	88	94	91	86

Source: Appendix Table 7.

Table 13. Grain sorghum price as a percentage of the price of corn in Northeastern Mississippi, by month, 1968-1972.

Month	1968	1969	1970	1971	1972
	----------Percent----------				
August	89	84	73	84	92
September	87	84	77	78	87
October	86	87	81	83	90
November	89	98	85	88	93
December	91	95	85	90	95
January	91	93	86	94	94
February	95	96	87	93	91
March	95	95	89	95	92
April	95	92	91	94	92
May	93	91	92	93	84
June	92	90	92	94	83
July	93	88	96	93	84

Source: Appendix Table 7.

Table 14. Grain sorghum price as a percentage of the price of co in Southern Mississippi, by month, 1968-1972.

Month	1968	1969	1970	1971	19
	---------Percent--------				
August	87	83	72	82	8
September	84	82	76	77	8
October	87	87	79	81	8
November	86	94	84	86	9
December	88	92	83	88	9
January	86	91	84	92	9
February	92	93	85	91	8
March	92	93	87	93	9
April	93	90	89	92	9
May	91	89	90	91	8
June	90	89	90	91	8
July	90	86	94	90	8

Source: Appendix Table 7.

On-Farm Versus Commercial Drying and Storage

Elevator operators usually sell grain sorghum to feed mills that will only accept relatively large volumes of grain. When an elevator buys grain from farmers, there is uncertainty as to whether procurements will be adequate to meet the demands of feed mills.

Mississippi farmers normally sell their grain sorghum during the harvesting period. Grain sorghum sold at this time must compete with soybeans for limited storage space and drying facilities at commercial elevators. Since soybean production greatly exceeds grain sorghum production in most areas of the State, it appears logical that elevators would prefer to fill available bins with soyb rather than to partially fill with grain sorghum. As a r grain sorghum prices in Miss pi are relatively low d harvest. The relatively low p paid by grain handlers for sorghum during the harve riod indicate that an alternative selling to local elevators at rvest holds promise for increasing the profitability of grain rghum production.

Two alternative marketing ograms examined in this section e on-farm and commercial dry- and storage. These marketing ograms allow greater flexibility realizing the advantages of asonal prices and of the options sociated with grain sorghum pport prices and loans.

No recent data concerning onm drying and storage costs are ailable. Therefore, the pershel cost of on-farm drying in 70 was computed by adjusting t data published in 1959 (10), us- the index of prices paid by mers for major supplies. Onm storage costs from the same rce were updated to 1970 by us- the index of prices paid by mers for building supplies.

/e computed the cost of drying 500-bushel capacity drier used ry 20,000 bushels annually. The t data published in 1959 were for ucing moisture from 25 percent 8 percent. However, the normal ctice in Mississippi is to reduce moisture content of grain ghum from 18 percent to 14 per-. Therefore, we reduced our puted cost by one half to ide a more accurate estimate of cost of drying. Our estimates of age cost were based on storing grain in metal bins with a 4,400- el capacity.

ur estimated total cost of dry- and storing grain sorghum is cents per bushel per year---8.8 s for drying and 12.0 cents for ng. Fixed cost comprise the r part of the cost of storing n after it is dried; therefore, the th of time of storage affects storage cost only slightly. , our estimates are for the ical storage operation only realistically, a charge should dded to reflect a credit for int on the value of stored grain.

Table 15. Moisture discount schedule for grain sorghum.*

Moisture	Discount
	--cents per bu.--
14.0 - 14.5	1.7
14.6 - 15.0	3.4
15.1 - 15.5	5.0
15.6 - 16.00	6.7
16.1 - 16.5	8.4
16.6 - 17.0	10.1
17.1 - 17.5	11.8
17.6 - 18.0	13.4

***Basis: No. 2 grain sorghum with 14 percent moisture content.**

Source: Charles C. Baskin and Truett S. Bufkin, ***Profitable Grain Sorghum Production,*** **USDA, Mississippi Extension Service, Pub. 350, 1972.**

Charges for drying grain sorghum in commercial facilities were not available; therefore, we computed estimates of these charges from a moisture discount schedule (Table 15). The discount for grain sorghum of 18 percent moisture content is approximately 13.5 cents per bushel. At the average price of grain sorghum during the period studied, the four percent weight loss from drying resulted in a loss of about 4.5 cents per bushel. Subtracting this from the total moisture discount, gives an allowance of about nine cents per bushel for commercial drying.

A commercial storage charge of 1.2 cents per bushel per month for the first year that grain is stored is allowed by the 1971 Uniform Grain Storage Agreement. However, a charge of 1.5 cents more nearly covers elevator costs and appears to be a more reasonable charge by elevators. The Uniform Grain Storage Agreement allows seven cents per bushel for receiving and loading out at elevators.

On-farm drying of grain sorghum in Mississippi appears to be less costly than commercial drying. Since the on-farm storage cost of grain sorghum is an estimated 12.0 cents per bushel per year and the commercial rate is 1.5 cents per bushel per month plus the seven cent in-and-out charge, the farmer who does not already have available on-farm storage and who plans to store grain no longer than three to four months may find commercial storage cheaper. On-farm storage appears to be cheaper for periods of storage longer than this or if the storage space may be used for storing other grains at different times of the year.

If a producer already owns farm storage facilities, he will incur approximately an eight cent per bushel fixed cost regardless of whether he stores---for depreciation, interest on investment, insurance and taxes. Thus, once the investment is made in facilities, the only costs entering the storage decision are the variable costs of putting grain into storage, holding it in storage and removing it from storage. Although our estimates of farm storage costs allow for average quantity and quality losses, the producer who stores grain bears the full risk of such losses. Much of this risk can be passed to the elevator by using commercial storage.

Prices paid to Mississippi farmers in the past do not provide a clear-cut indication of when to sell grain sorghum. However, on average, July represented the highest price (Table 10). In all but one of the years included in our study, the highest prices received were in July. The prices in the major harvest months---September and October---were lowest in three of the five years.

There are uncertainties when a farmer stores grain for long periods. Although the average prices of grain sorghum indicate that July is the best month to sell, this does not mean that the highest price will always be received in that month.

Appendix Tables

Appendix Table 1. Barge rates for grain sorghum between selected points via Mississippi River, Jan. 1, 1968-Dec. 31, 1972.

	Jan. 1 1968	Jul. 1 1969	Jan. 1 1970	Aug. 23 1971	Oct. 1 1972
	cents per bu.				
From Kansas City, Mo. To					
Vicksburg	13.27	12.63	13.27	13.41	13.97
Memphis	10.64	10.14	10.64	11.03	11.59
Greenville	12.32	11.73	12.32	12.55*	13.11*
To New Orleans, La. (Export) From					
Vicksburg	4.45	4.45	4.67	4.68	5.24
Memphis	6.33	6.33	6.63	6.63	7.20
Greenville	4.45	4.45	4.67	4.68	5.24

*Rate was interpolated.

Source: Arrow Transportation Company, *Guide To Published Barge Rates On Bulk Grain,* (schedules no. C and supplement no. 1 to 6, no. 7, and no. 8).

Appendix Table 2. Truck charges for grain sorghum betw selected points.

Origin	Jackson	Indianola	Tup
	cents per bushel		
Vicksburg	6.07	—	-
Greenville	—	5.36	-
Memphis	—	—	7
New Orleans	10.68	14.26	15
Fort Worth	18.90	18.78	23
Kansas City	26.52	23.54	22

Source: Rates computed from function C = 4.6 + 3.2X and the tances presented in Appendix Table 3.

Appendix Table 3. Road miles between selected points.

Origin	Jackson	Indianola	Tupelo
	miles		
Vicksburg	46	—	—
Greenville	—	24	—
Memphis	—	—	--
New Orleans	190	302	344
Fort Worth	447	443	597
Kansas City	685	592	568

Source: Standard Highway Mileage Chart, Rand McNally and Company.

pendix Table 4. Rail rates for grain sorghum between selected points, Jan. 1, 1968-Dec. 31, 1972.

	Jan. 1 1968	Apr. 3 1970	July 1 1970	Nov. 20 1970	Apr. 12 1971	June 16 1972	Oct. 23 1972
	(cents per bu.)						
m							
sas City, Mo.							
(Miss.)							
kson[1]	16.55		18.48	20.27	20.55		21.14
pelo[1]	14.78		16.44	18.20	18.48		19.05
lianola[2]	16.46		18.40	20.16	20.44		21.03
m							
Worth, Tx.							
(Miss.)							
kson[3]	39.20	25.59		28.64	29.20		30.02
elo[3]	39.20	25.59		28.64	29.20		30.02
ianola[4]	40.54	27.08		30.24	30.80		31.67
Orleans, La.							
ort) From (Miss.)[5]							
kson	19.32[6]		22.40[6]	23.52[6]	24.92[6]	24.92[7] 21.00[8]	25.76[7] 21.56[8]
elo	22.96[6]		25.20[6]	27.44[6]	28.56[6]	28.56[7] 25.48[8]	29.40[7] 26.32[8]
ianola	22.96[6]		26.88[6]	29.12[6]	30.52[6]	30.52[7] 26.60[8]	31.36[7] 27.44[8]

hree cars per shipment.
hree cars to Cairo, Illinois, single car beyond.
ingle car to Memphis, Tennessee, three cars beyond.
ngle car.
ates do not include port charge at New Orleans.
pplicable in bulk or other than bulk.
pplicable only in bulk.
pplicable only when other than bulk.

rce: Navigation Economics Branch, Tennessee Valley Authority.

Appendix Table 5. Estimated transportation costs for grain sorghum between selected poin mode of transportation, 1968-1972.

	Date	Truck	Date	Rail	Date	Barge-T
From Kansas City To (Miss.)						
Jackson	Jan. 1, 1968 Dec. 31, 1972	26.52	Jan. 1, 1968	16.55	Jan. 1, 1968	25.3
			Jul. 1, 1970	18.48	Jul. 1, 1968	24.7
			Nov. 20, 1970	20.27	Jan. 1, 1970	25.3
			Apr. 12, 1971	20.55	Aug. 23, 1971	25.4
			Oct. 23, 1972	21.14	Oct. 1, 1972	26.0
Tupelo	Jan. 1, 1968 Dec. 31, 1972	22.78	Jan. 1, 1968	14.78	Jan. 1, 1968	24.4
			Jul. 1, 1970	16.44	Jul. 1, 1968	23.9
			Nov. 20, 1970	18.20	Jan. 1, 1970	24.4
			Apr. 12, 1971	18.48	Aug. 23, 1971	24.8
			Oct. 23, 1972	19.05	Oct. 1, 1972	25.3
Indianola	Jan. 1, 1968 Dec. 31, 1972	23.54	Jan. 1, 1968	16.46	Jan. 1, 1968	23.6
			Jul. 1, 1970	18.40	Jul. 1, 1968	23.0
			Nov. 20, 1970	20.16	Jan. 1, 1968	23.6
			Apr. 12, 1971	20.44	Aug. 23, 1971	23.9
			Oct. 23, 1972	21.03	Oct. 1, 1972	24.
From Fort Worth To (Miss.)						
Jackson	Jan. 1, 1968 Dec. 31, 1972	18.90	Jan. 1, 1968	39.20		
			Jul. 1, 1970	25.59		
			Nov. 20, 1970	28.64		
			Apr. 12, 1971	29.20		
			Oct. 23, 1972	30.02		
Tupelo	Jan. 1, 1968 Dec. 31, 1972	23.70	Jan. 1, 1968	39.20		
			Jul. 1, 1970	25.59		
			Nov. 20, 1970	28.64		
			Apr. 12, 1971	29.20		
			Oct. 23, 1972	30.02		
Indianola	Jan. 1, 1968 Dec. 31, 1972	18.78	Jan. 1, 1968	40.54		
			Jul. 1, 1970	27.08		
			Nov. 20, 1970	30.24		
			Apr. 12, 1971	30.80		
			Oct. 23, 1972	31.67		
To New Orleans (f.o.b. vessel) From						
Jackson	Jan. 1, 1968 Dec. 31, 1972	12.68[4]	Jan. 1, 1968	21.32[4]	Jan. 1, 1968	18.
			Jul. 1, 1970	24.40[4]	Jul. 1, 1968	18.
			Nov. 20, 1970	25.52[4]	Jan. 1, 1970	18.
			Apr. 12, 1971	26.92[4]	Aug. 23, 1971	18.
			Jun. 16, 1972	26.92[4]	Oct. 1, 1972	19.
			Oct. 23, 1972	27.76[4]		
Tupelo	Jan. 1, 1968 Dec. 31, 1972	17.60[4]	Jan. 1, 1968	24.96[4]	Jan. 1, 1968	22
			Jul. 1, 1970	27.20[4]	Jul. 1, 1968	22
			Nov. 20, 1970	29.44[4]	Jan. 1, 1970	22
			Apr. 12, 1971	30.56[4]	Aug. 23, 1971	22
			Jun. 16, 1972	30.56[4]	Oct. 1, 1972	23
			Oct. 23, 1972	31.40[4]		

(continued)

endix Table 5. Estimated transportation costs for grain sorghum between selected points, by e of transportation, 1968-1972. (continued)

	Date	Truck	Date	Rail	Date	Barge-Truck
nola	Jan. 1, 1968 Dec. 31, 1972	16.26[4]	Jan. 1, 1968	24.96[4]	Jan. 1, 1968	17.81[7]
			Jul. 1, 1970	28.88[4]	Jul. 1, 1968	17.81[7]
			Nov. 20, 1970	31.12[4]	Jan. 1, 1970	18.03[7]
			Apr. 12, 1971	32.52[4]	Aug. 23, 1971	18.04[7]
			Jun. 16, 1972	32.52[4]	Oct. 1, 1972	18.60[7]
			Oct. 23, 1972	33.36[4]		

arge rates to Vicksburg plus 6.07 cents trucking, 5 cents handling, and 1 cent merchandising ges to Jackson.

arge rates to Memphis plus 7.80 cents trucking, 5 cents handling, and 1 cent merchandising ges to Tupelo.

arge rates to Greenville plus 5.36 cents trucking, 5 cents handling, and 1 cent merchandising ges to Indianola.

ncludes adjustments in prices of 2.00 cents in handling to f.o.b. vessel.

ncludes adjustment in prices of 6.07 cents in trucking and 8 cents in handling and merchandising barge rate of f.o.b. vessel.

ncludes adjustments in prices of 7.80 cents in trucking and 8 cents in handling and merchandising barge rate of f.o.b. vessel.

ncludes adjustments in prices of 5.36 cents in trucking and 8 cents in handling and merchandising barge rate to f.o.b. vessel.

ndix Table 6. No. 2 Yellow Grain Sorghum: Monthly average prices in selected Mississippi kets by month, 1968-1972.

r and nth	Jackson[1]	Indianola[1]	Tupelo[1]	New Orleans[2]	Kansas City[1]	Fort Worth[2]
	--------------(cents per bushel)--------------					
ust	101	101	101	107	99	119
ember	98	98	98	111	99	118
ber	101	101	101	118	102	122
ember	110	116	110	122	107	126
mber	112	112	112	120	106	126
ary	116	116	116	123	109	127
uary	121	121	121	121	108	127
ch	121	121	121	121	108	127
l	126	126	126	122	110	127
	130	130	130	125	112	129
	129	129	129	117	113	132
	129	129	129	120	115	136
ust	118	120	118	127	117	137
ember	112	113	112	129	116	138
ber	117	119	117	133	116	140
ember	128	128	128	131	115	134
mber	127	127	127	129	115	137
ary	129	129	129	130	116	138
uary	134	132	134	130	114	137
ch	131	130	131	125	110	137
l	129	127	129	124	112	132

(continued)

Appendix Table 6. No. 2 Yellow Grain Sorghum: Monthly average prices in selected Missis markets by month, 1968-1972. (continued)

Year and Month	Jackson[1]	Indianola[1]	Tupelo[1]	New Orleans[2]	Kansas City[1]
			(cents per bushel)		
May	129	127	129	124	110
June	133	132	133	123	114
July	133	134	133	123	117
1970					
August	114	115	114	129	122
September	126	125	126	144	128
October	127	127	127	143	124
November	133	133	133	140	119
December	141	140	141	144	127
January	146	145	146	148	133
February	146	146	146	151	132
March	148	147	148	148	130
April	148	149	148	152	135
May	149	150	149	155	138
June	155	155	155	159	144
July	152	153	152	146	142
1971					
August	117	117	116	132	126
September	98	97	98	123	101
October	96	96	96	122	101
November	107	110	107	128	107
December	118	118	118	137	115
January	123	123	123	135	115
February	122	122	122	136	116
March	125	125	125	136	116
April	126	126	126	137	117
May	127	127	127	131	116
June	126	126	126	127	117
July	127	128	127	132	118
1972					
August	127	127	127	139	114
September	130	127	130	148	124
October	132	132	132	145	122
November	140	139	140	157	136
December	165	165	165	194	161
January	167	167	167	207	171
February	162	167	162	199	161
March	162	169	162	194	160
April	164	165	164	189	158
May	184	188	184	196	173
June	221	227	221	222	202
July	224	234	224	257	218

[1] Simple average of weekly, delivered carlot or truck, cash price. *Feed Market News*, Grain Di Agricultural Market News Service, U. S. Department of Agriculture.

[2] Simple average of daily closing, f.o.b. vessel, cash price. *Grain Market News*, Grain Divisio sumer and Marketing Service, U. S. Department of Agriculture.

Appendix Table 7. No. 2 Yellow Corn and No. 2 Yellow Sorghum: monthly average prices[1] in selected Mississippi markets, by month, 1968-1972.

Year and Month	--Delta--		--Northeast--		--South--	
	Corn	Grain Sorghum	Corn	Grain Sorghum	Corn	Grain Sorghum
	--------------	------cents per bushel	------	--------------		
1968						
August	115	101	113	101	116	101
September	116	98	113	98	116	98
October	116	101	114	101	117	101
November	127	116	123	110	128	112
December	127	112	123	112	127	112
January	130	116	127	116	131	116
February	130	121	127	121	131	121
March	131	121	128	121	131	121
April	134	126	132	126	136	126
May	141	130	140	130	143	130
June	142	129	140	129	143	129
July	142	129	139	129	143	129
1969						
August	143	120	140	118	143	118
September	138	113	133	112	136	112
October	136	119	132	117	135	117
November	136	128	131	128	136	128
December	136	127	134	127	138	127
January	142	129	138	129	142	129
February	142	132	140	134	144	134
March	140	130	138	131	141	131
April	141	128	140	129	144	129
May	143	127	141	129	145	129
June	148	132	147	133	150	133
July	153	134	152	133	155	133
1970						
August	160	115	156	114	159	114
September	165	125	163	126	165	126
October	159	127	157	127	161	127
November	156	133	156	133	159	133
December	167	140	166	141	170	141
January	172	145	170	146	173	146
February	172	146	168	146	171	146
March	169	147	166	148	170	148
April	166	149	163	148	166	148
May	165	150	162	149	165	149
June	172	155	169	155	173	155
July	162	153	158	152	162	152

(continued)

Appendix Table 7. No. 2 Yellow Corn and No. 2 Yellow Sorghum: monthly average prices in selected Mississippi markets, by month, 1968-1972. (continued)

Year and Month	--Delta--		--Northeast--		--South--	
	Corn	Grain Sorghum	Corn	Grain Sorghum	Corn	Grain Sorghum
	-------------cents per bushel-------------					
1971						
August	143	117	138	116	142	117
September	130	97	126	98	128	98
October	118	96	115	96	118	96
November	123	110	121	107	124	107
December	133	118	131	118	134	118
January	133	123	131	123	134	123
February	133	122	131	122	134	122
March	134	125	131	125	135	125
April	135	126	134	126	137	126
May	138	127	136	127	134	127
June	136	126	134	126	138	126
July	140	128	137	127	141	127
1972						
August	142	127	133	127	143	127
September	145	127	150	130	154	130
October	149	132	146	132	150	132
November	154	139	151	140	154	140
December	177	165	174	165	178	165
January	184	167	178	167	182	167
February	180	167	178	162	181	162
March	178	169	176	162	180	162
April	179	165	178	164	181	164
May	221	188	219	184	224	184
June	271	227	265	221	269	221
July	272	234	268	224	272	224

[1] Simple average of weekly cash price, delivered carlot or truck.

Source: *Feed Market News,* Grain Division Agricultural Market News Service, U. S. Department of Agriculture.

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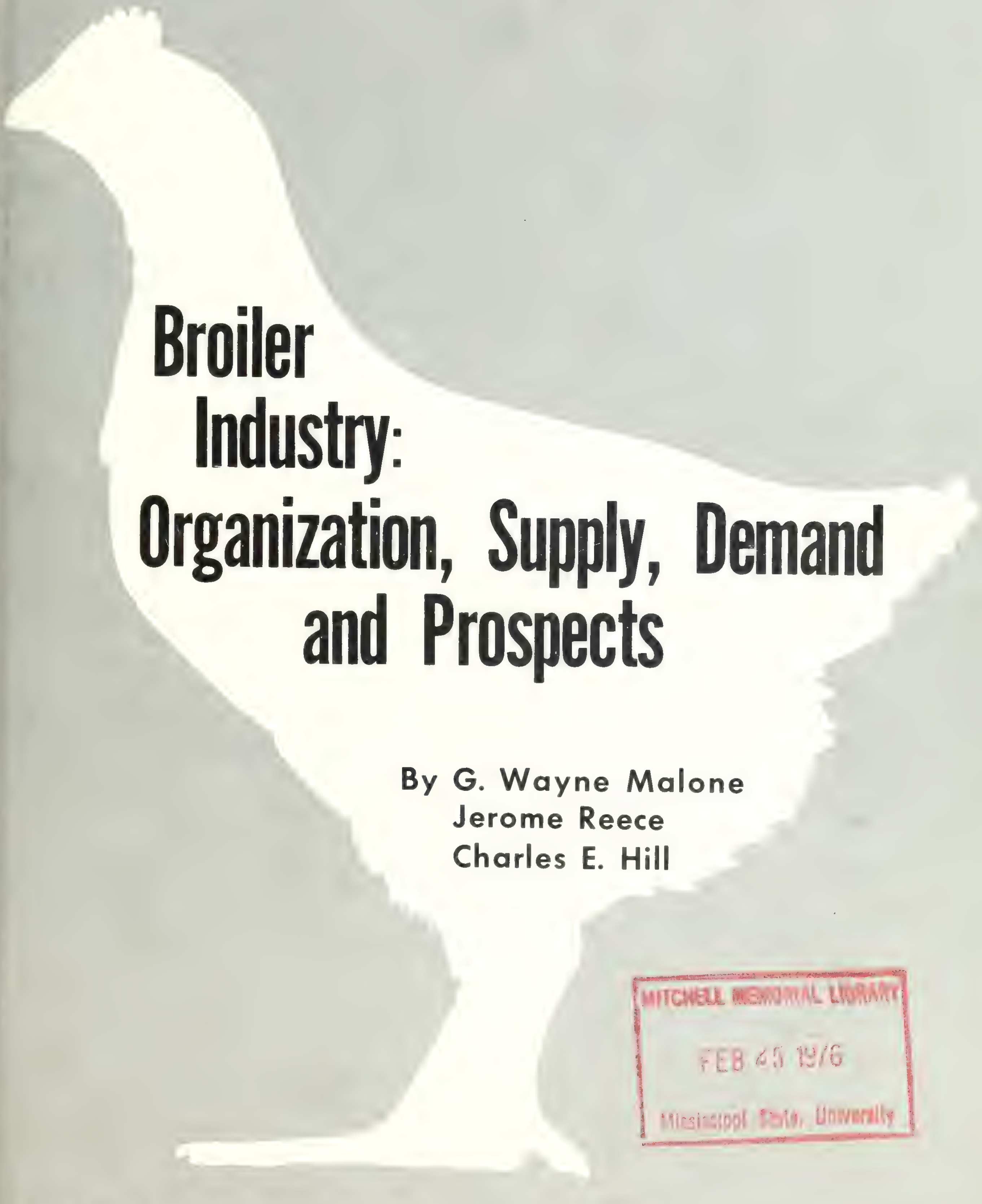

Broiler Industry: Organization, Supply, Demand and Prospects

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Broiler Industry: Organization, Supply, Demand and Prospects

By **G. Wayne Malone,** Assistant Agricultural Economist, **Jerome Reece,** Graduate Research Assistant and **Charles E. Hill,** Graduate Research Assistant, MAFES Department of Agricultural Economics

Introduction

The rapid growth of the commercial broiler industry in the United States is generally recognized and well documented (3,4,13,16).[1] Per capita consumption increased by almost 55% between 1960 and 1974---from 24.3 pounds to 37.5 pounds. In 1969, the $1.53 billion gross farm income from broilers for the nation was 2.8 percent of total realized gross farm income (3). This was up from $19 million in 1934, when the broiler share of farm income was only 0.2 percent.

The broiler industry also is an important sector of Mississippi's agricultural economy. Processing plants in the state slaughtered 239.1 million birds in 1973 with an approximate producer value of $207.9 million (20). This volume continued to place Mississippi fifth in the nation in broiler production.

The broiler industry is considered to have further growth potential. Per capita consumption increased from 0.5 pounds in 1934 to 37.5 pounds in 1974 and it has been predicted that consumption will approach 41.4 pounds by 1985 (3).

The growth of the broiler industry and its potential for further growth are attributed primarily to the technical efficiencies gained in production and processing. Efficiencies have been gained through integration---the ownership and contract linkages of successive stages of production, processing and marketing. Processing efficiency has been improved as evidenced by the decrease in numbers of plants and the resulting larger throughput of the ones in business now. However, there now is excess processing capacity and using existing facilities at capacity would result in declining prices and less than normal returns to the industry.

All dynamic industries---and few, if any, are more dynamic than the broiler industry---must probe the future. Basic questions to which the broiler industry requires answers are:

1. What changes can be expected in the structure and operating practices of the industry?
2. What do the prevailing price-quantity relationships indicate for the future of the industry?
3. What is the potential for supply management by the industry---particularly since it is a highly integrated industry operating at less than its processing capacity?

---

[1] *Numbers in parentheses refer to Literature Cited at the end of the bulletin.*

Objectives and Procedures

We initiated a study designed to more fully document the current status of the broiler industry and to generate information needed for answering the questions now being posed by the industry. Our specific objectives were to:

1. Examine the current structural and operational status of the broiler industry,
2. Analyze current supply-demand relationships,
3. Estimate the potential demand for broilers relative to the supply capacity of the industry, and
4. Evaluate the potential effect of unexpected supply-demand relationships on the structure and operating practices of the broiler industry, including the potential for supply management by the industry.

Current operating practices of the Mississippi broiler industry were obtained by a survey of broiler firms. Expected changes in the structure and operational practices of the industry were obtained by a survey of broiler firms throughout the Southeast. Supply-demand relationships were estimated by statistical analysis of time series data.[2]

Structure, Organization and Marketing Practices

The broiler industry in the United States is concentrated on a regional basis.[3] There are relatively few buyers and sellers of dressed broilers and competitive emphasis is on price at the wholesale level, with buyers having the overall balance of power (6,18). This power balance has been granted to buyers by the broiler industry as a consequence of the rapid infusion of technology that has resulted in the great expansion in broiler production and processing capacity.

The National Commission on Food Marketing projected in 1966 that 31 firms would handle 70 percent of the broiler volume in 1972 (13). This projection was virtually substantiated by a report that 34 firms supplied 70 percent of the Nation's broiler volume in 1970 (12). Even so, the National Commission concluded that concentration in the broiler industry was low relative to that prevailing in the processing and distribution of most other foods. However, these studies indicated that the largest firms were expected to handle larger shares of future broiler output.

Most broiler firms in the United States are corporations. Only four of the major firms are recognized as cooperatives and only two of these are ranked among the top 25 firms (13). Integrated cooperatives account for only about 10 percent of total broiler output (17) but an additonal small segment of the industry is cooperative, in that a small number of integrated firms participate jointly in processing.

The Mississippi broiler industry--Our survey indicated that eight of the 13 integrated broiler processors in Mississippi had expanded in the last five years. Also, six of the eight who had expanded in the last f e years indicated their intentions n additional expansion (5). O y three of the Mississippi process s reported per hour processi g capacity of 6,000 birds or les - eight of the 13 were at or above e 9,000 bird capacity.

Over two thirds of the bi s processed in Mississippi w e supplied by contract grow s (Table 1). Most of the birds proce ed by firms of medium size ca e from contract growers. The sm ll processors relied heavily n production from their own farm

Two thirds of the birds process d came from within 25 miles of e plant and another 28 percent w e drawn from within 50 miles. T e procurement area was smaller a d supply of live birds was much m e concentrated than it was alm t twenty years ago (1).

---

[2] *See the Appendix for details of the statistical procedures and results.*

[3] *It has been described as a type of bilateral oligopoly with competitive fringes.*

Table 1. Procurement of birds, by type of supplier, by size of firm, 13 broiler processing firms, Mississippi, 1971.

Type of supplier	Size of firm[1] Small	Medium	Large	All firms
	-------Percent-------			
Contract growers	39	94	72	67
Company farms	45	4	27	27
Company leased farms	7	2	0	2
Officers and directors	9	0	2	3
All sources	100	100	100	100

[1] Small, 6,000 and less (rated capacity, per hour); Medium, 6,001 to 9,000 birds; Large, over 9,000 birds.

Table 2. Distribution of output, by type of product, by size of firm, 13 broiler processing firms, Mississippi, 1971.

Type of Product	Size of Firm[1] Small	Medium	Large	All firms
	-------Percent-------			
Fresh				
Whole	67	72	69	69
Cut-up	17	10	11	12
Total Fresh	84	82	80	81
Frozen				
Whole	10	10	6	8
Cut-up	6	8	14	11
Total Frozen	16	18	20	19
All Products	100	100	100	100

[1] Small, 6,000 and less (rated capacity, per hour); Medium, 6,001 to 9,000 birds; Large, over 9,000 birds.

Slightly over one third of the tal output of the Mississippi oiler processing industry in 1971 ent directly from the plant to tailers and 56 percent of the in-istry's output went to retailers ırough various wholesale in-rmediaries (Figure 1). Exports ac-ounted for slightly more than 7 percent of the broilers processed in that year.

Mississippi processors sell both fresh and frozen broilers, either whole or "cut-up."[4] Slightly less than 20 percent of their 1971 output was sold frozen---the form that accounts for most exports. More than 23 percent of their sales were "cut-up" (Table 2), representing a 4 percent increase over their 1965 sales (13).

Price discovery continues to be a major problem of the broiler industry. Most of the output of processors is priced and committed for delivery a week in advance. Price reporting is adequate but remains "after-the-fact" for decision-making purposes. Therefore, most sales managers in Mississippi supplement their knowledge of immediate past prices with knowledge gained by telephone contacts with other suppliers a with buyers.

---

[4] *A private survey of meat merchandisers indicated a wide range in the proportion of "cut-up" broilers handled). The tonnage moved as whole birds ranged from 30 to 60 percent, whole "cut-up" ranged from 10 to 25 percent d parts ranged from 25 to 60 percent.*

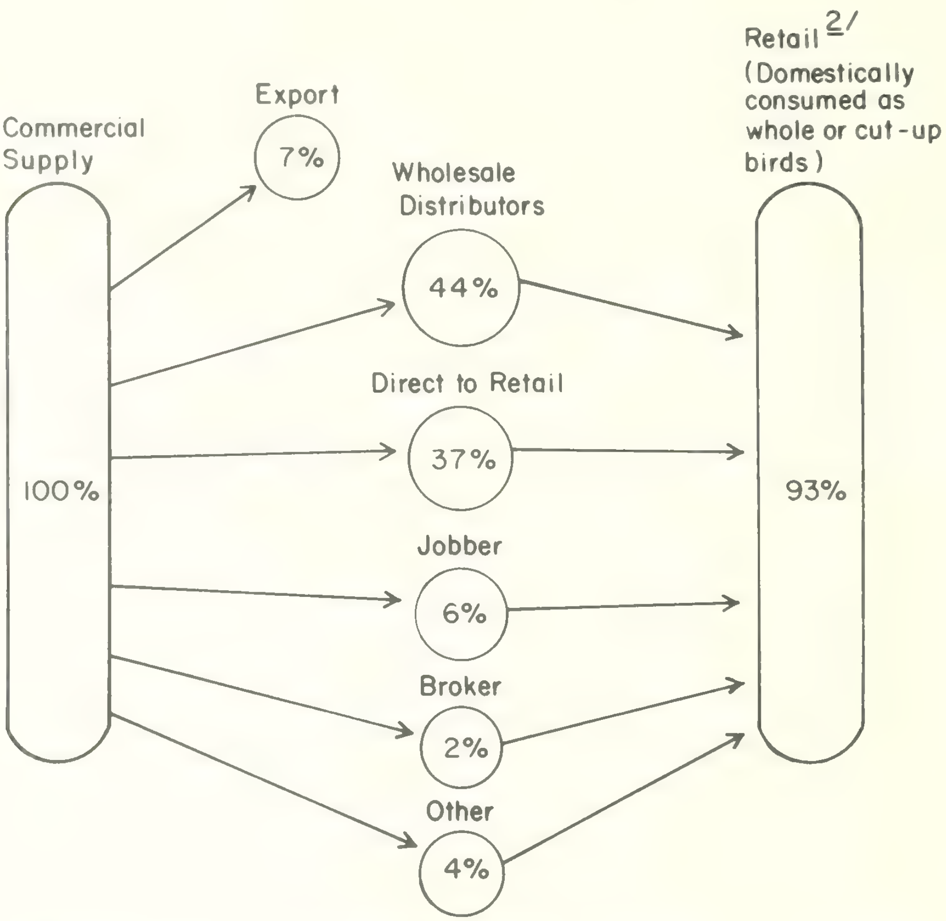

Figure I. Major marketing channels for broilers, 13 broiler processing firms, Mississippi, 1971.1/

1/ Adapted from "The Chicken Broiler Industry: Structure, Practices, and Costs", USDA, ERS, Marketin Research Report No. 930, P. 30, Figure 4, May 1971.

2/ Includes stores, institutions, and restaurants.

Demand and Supply

Casual observation of time series data reveals distinct seasonal---and even monthly---patterns of broiler slaughter and prices (Figures 2 and 3). Therefore, we estimated supply and demand functions by months using traditional explanatory variables.[5]

Our estimates reveal that broiler demand in eight months (March-October) exceeded that for January and was less than that for January in three months (February, November, December).

The average price flexibility for the range of prices included in our estimates is -1.66; that is, a one million pound increase in the quantity of broilers available would have resulted in a price decrease of .08 cents or a quantity decrease one million pounds would ha resulted in a price increase of cents.

Our estimates reveal that supply of broilers also shifts imp tantly from month to month. Su ly was greater in eight mon (March-October) than it was January; less than that of Janu

[5] *See the Appendix for details of the statistical procedures and results.*

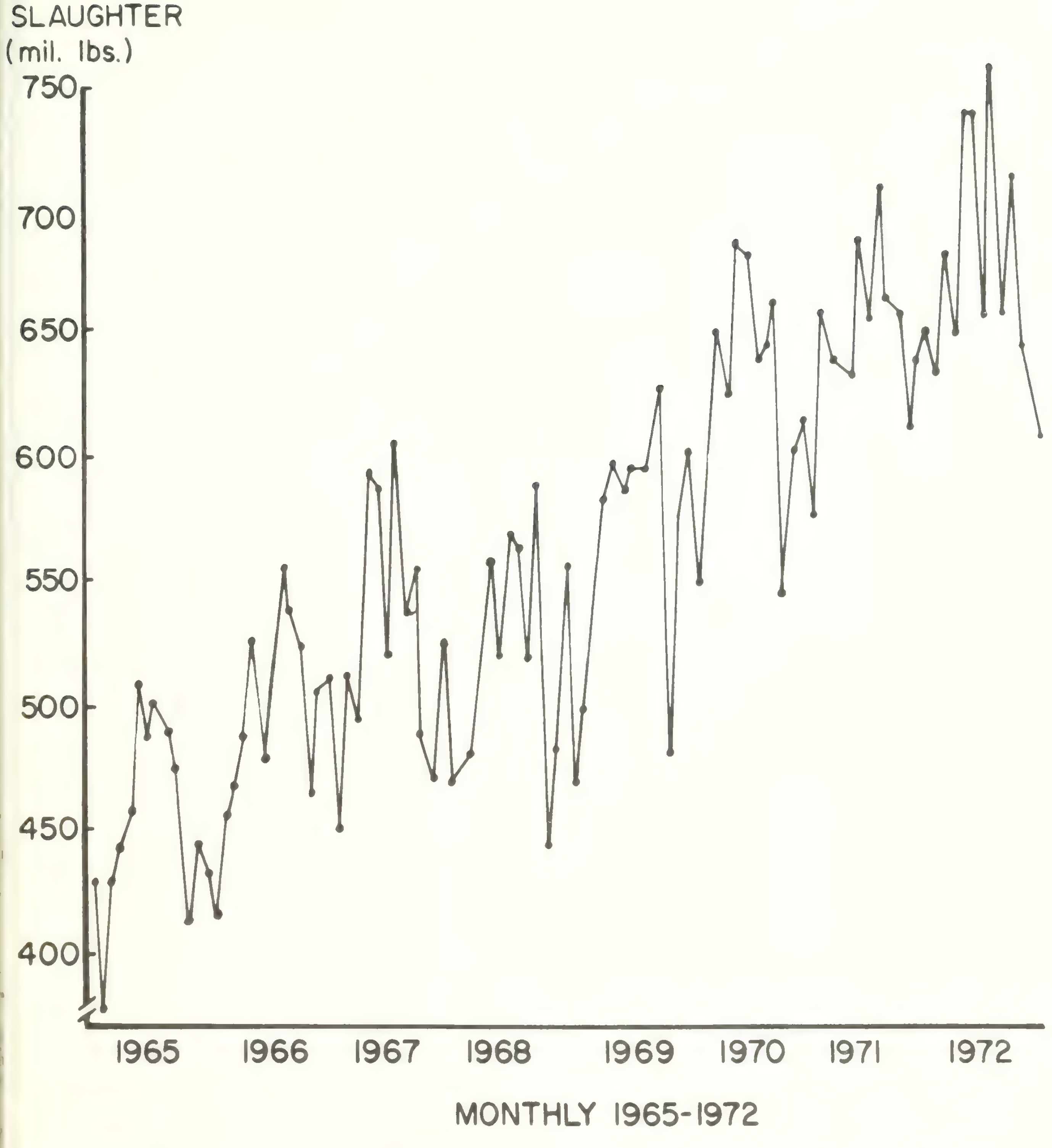

Figure 2. Illustrative time pattern of broiler slaughter.

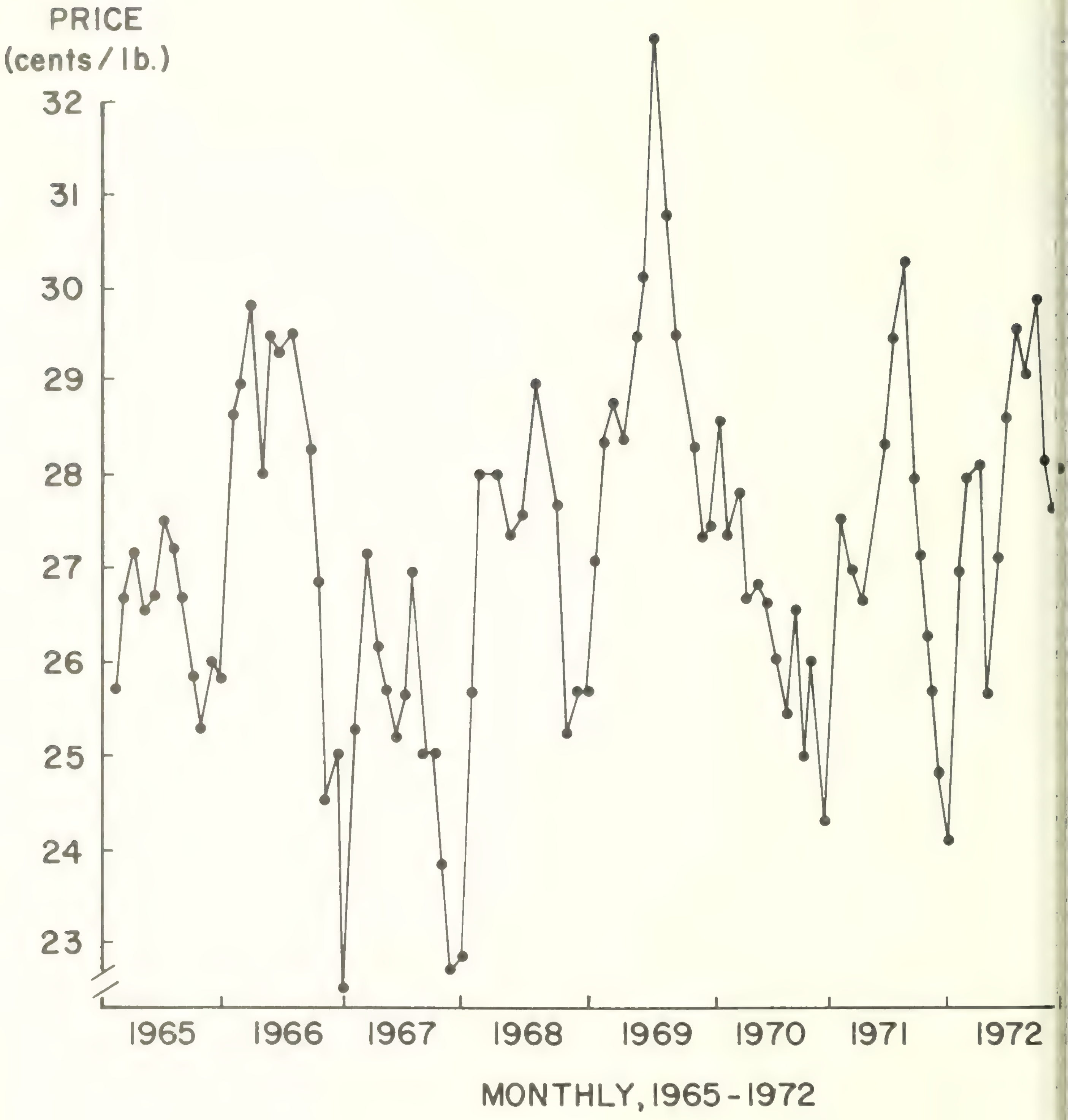

Figure 3. Illustrative time pattern of broiler price.

n February, November and ecember.

The slopes of the supply funcions relative to those of the denand functions indicate that a unit hange in price results in a smaller hange in the quantity offered for ale than in the quantity bought.

The price of pork, consumer inome and the size of the population ffected the demand for broilers nore importantly than did the ther variables included in our esimating equations. Cost of producion (primarily as influenced by the rice of production inputs) and rice expectations exerted more inluence on supply than did the ther variables considered in our tatistical procedures.

Production and marketing plans equire both short-and long-run onsiderations. Ordinarily, conumer income and the size of the opulation do not change apreciably from month to month. onsequently, the price of other neats, the prices of inputs used in he production of broilers and exectations of prices in the near uture are the major factors affecing short-run production and narketing decisions of broiler rocessors.

Both pork and beef are cometitors with broiler meat and the rices of both affect the demand for roilers more importantly than loes the price of either alone. Iowever, it appeared inapropriate to include prices of both ork and beef in our estimating quations because of the high legree of correlation between them. lso, pork appears to be the tronger competitor with broilers n the short run (8). Furthermore, he long-run trend in demand for eef is still upward relative to the demand for other meats (15) and the strength of this demand will affect the demand for pork and, hence, that for poultry. Consequently, the price of pork was used in our estimating equations.

Long-term demand shifts, however, depend largely upon changes in consumer income and upon the size and composition of the population. Larger populations in the future will require more food and continuation of the rising trend in consumer incomes will provide greater purchasing power, signaling an increase in demand for food over time.

Projections---Our equations have given short-run projections that have differed markedly from the quantities and prices of broilers that have prevailed in the immediate past, simply because some of our major variables have behaved abnormally as a result of major shocks to the national and the world economies---short-falls in food and feed grain production in many countries, the energy crisis, rising unemployment and continued inflation at home and unexpected market controls by the Federal Government.

We feel, however, that our estimating equations can be used to improve the accuracy of predictions of long run changes in the broiler industry, because of the greater reliability of trends in the major variables. Further increases in population are projected. Unemployment rates are expected to decline and consumer income is expected to resume its upward trend ---all of which tend to increase demand. Beef cattle numbers are at record highs and larger quantities of beef, much of it with less grain finish, are expected to be marketed. This will reduce the demand for pork which, in turn, will lead to a reduction in the demand for broilers.

Prices of the inputs required for livestock production, particularly feed for heavy consumers of grain, are expected to go up because of rising costs of farm production. This will lead to reductions in broiler supplies unless higher prices compensate for the higher costs of production or unless the broiler industry can find ways of using production inputs more efficiently.

On balance, it appears that the demand for all meats will continue to increase; that livestock producers can meet these demands only with higher prices, because of higher production costs; and that broiler meat will share in the overall increase, with the rate of growth in demand approximating that of past trends. And these are all hypotheses that can be tested with our estimating equations.

The expectations of industry leaders parallel the projections outlined above. All but one of 14 industry leaders interviewed expected the long-term demand for broiler meat to increase at a rate approximating that of the past ten years. Growth of the fast-food industry and the decline in meatcutting by supermarkets are expected to continue, leading to an increase in the proportion of broilers sold as "cut-up." (2). One respondent was highly optimistic as to the potential growth in demand for further processed broilers, most of the others were only mildly optimistic as to the potential for this. Forecasts by Jones (7) support the expectations of continued growth in further processing, but at a relatively slow rate.

ndustry Organization nd Supply Management

The broiler industry has epeatedly been documented as being highly vertically integrated (Figure 4). The decision-making function is centered in the processing sector where the responsibility for marketing rests and where profits of the industry are centered. However, procurement of breeding stock and marketing of the final product remain basically external to the broiler industry and these two major functions still are handled primarily by spot transactions.

A commonly-accepted goal of both consumers and producers of broilers is the maintenance of price stability, by adjusting supply to the changing demand. Obviously, supply adjustments may be made at any stage of production and processing over which an integrator has control.

Adjusting the supply of broile to expected long-run changes in d mand begins with the reduction (expansion of hatchery egg suppl However, increasing the supply (hatching eggs requires bringin more layers into production and i creasing the throughput of th processing plant by this meth

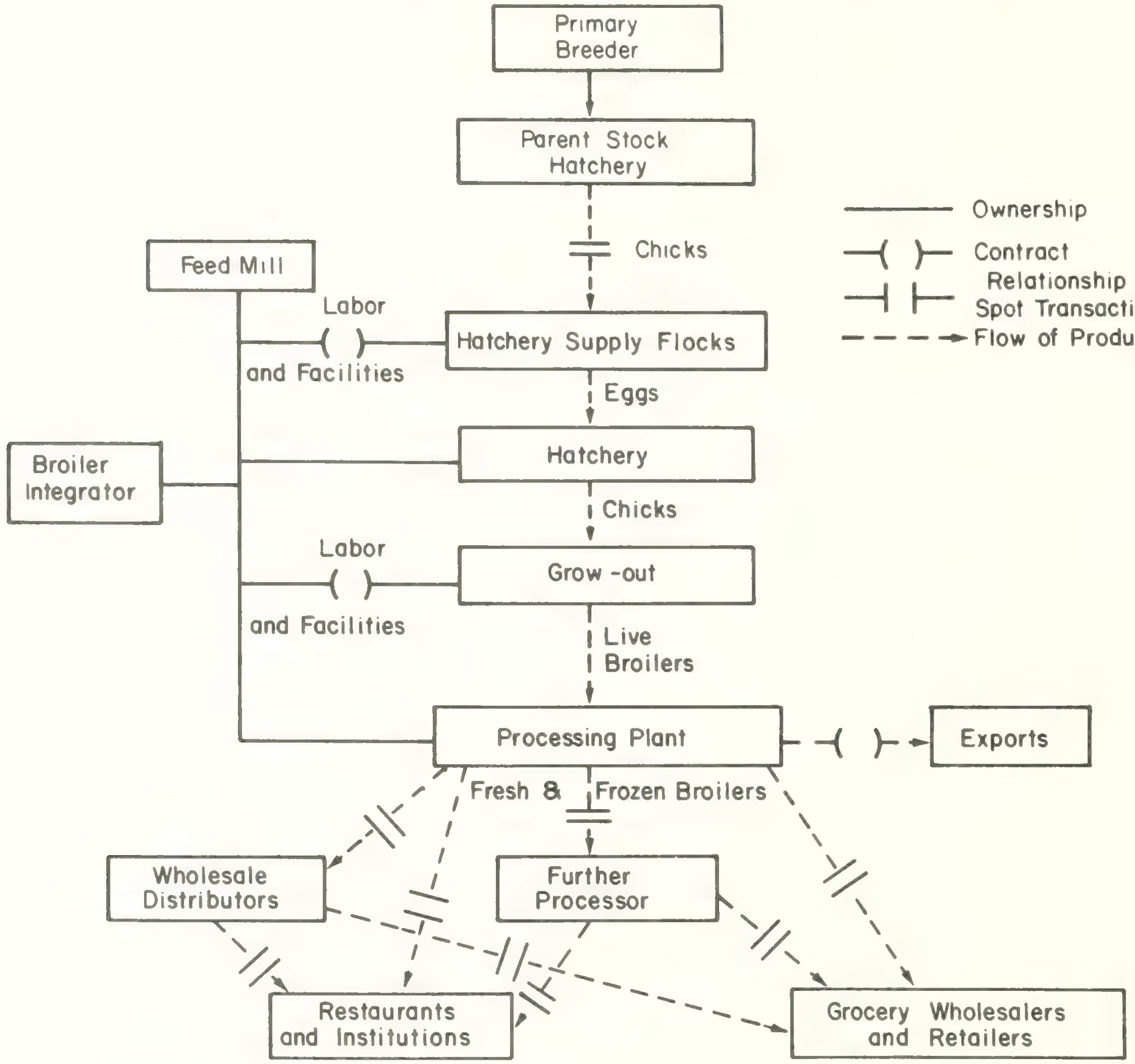
Primary Breeder
Parent Stock Hatchery
Chicks
Ownership
Contract Relationship
Spot Transaction
Flow of Product
Feed Mill
Labor
and Facilities
Hatchery Supply Flocks
Eggs
Broiler Integrator
Hatchery
Chicks
Labor
and Facilities
Grow -out
Live Broilers
Processing Plant
Exports
Fresh & Frozen Broilers
Wholesale Distributors
Further Processor
Restaurants and Institutions
Grocery Wholesalers and Retailers

Figure 4. Stages, Proprietary Structure, and Linkages Typical of the Broiler System in 1970.

Source: B.W. Marion and H.B. Arthur, Dynamic Factors in Vertical Commodity Systems: A Case Study of the Broiler System. Ohio Agricultural Research and Development Center, Bulletin 1065, November, 1973.

cannot be accomplished short of about ten months. Also, after new flocks for producing hatching eggs come into production, the influence on the quantity of broilers available for processing will prevail for nearly 18 months. (10).

Estimates of long-run changes in demand most likely will be less than perfect. Also, even if long-run estimates are "on target," short-run shifts in demand likely will leave the processor with the problem of coping with surpluses or deficits of live broilers. In this event, the most feasible alternatives for adjusting supplies appear to be:

— Changing the laying period of existing hatchery supply flocks,
— Diverting hatching eggs to other uses (breaking, disposal, etc.) or purchasing additional hatching eggs,
— Changing standards for hatching eggs,
— Changing standards for placing broiler chicks,
— Selling or purchasing broiler chicks.

Summary

The growth of the broiler industry and its potential for further growth are attributed primarily to the technical efficiencies gained in production and processing. Efficiencies have been gained through integration---the ownership and contract linkages of successive stages of production, processing and marketing. Processing efficiency has been improved by the decrease in numbers of plants and the larger throughput of the ones in business now. However, there now is excess processing capacity and using existing facilities at capacity would result in declining prices and less than normal returns to the industry.

There are relatively few buyers and sellers of dressed broilers and competitive emphasis is on price, with buyers having the overall balance of power. Price discovery continues to be a major problem. Most of the output of processors is priced and committed for delivery a week in advance. Price reporting is adequate but remains "after-the-fact" for decision-making purposes. Therefore, most sales managers in Mississippi supplement their knowledge of immediate past prices with knowledge gained by telephone contacts with other suppliers and with buyers.

Casual observation of time series data reveal distinct seasonal---and even monthly---patterns of broiler slaughter and prices. Our estimates, based on 1965-72 data, reveal that broiler demand in eight months (March-October) exceeded that for January and was less than that for January in three months (February, November, December). Supply was greater in eight months (March-October) than it was in January; less than that of January in Februrary, November and December. The slopes of the supply functions relative to those of the demand functions indicate that a unit change in price results in a smaller change in the quantity offered for sale than in the quantity bought.

The price of pork, consumer income and the size of the population affected the demand for broilers more importantly than did the other variables included in our estimating equations. Cost of production (primarily as influenced by the price of production inputs) and price expectations exerted more influence on supply than did the other variables considered in our statistical procedures.

Our equations have given estimates that have differed markedly from the quantities and prices that have prevailed in the immediate past, simply because some of our major variables have behaved abnormally as a result of major shocks to the national and world economies---short-falls in food and feed grain production in many countries, the energy crisis, rising unemployment and continued inflation at home and unexpected market controls by the Federal Government.

APPENDIX

General Model

Supply and demand functions were postulated on a monthly basis using traditional economic explanatory variables and zero-one (dummy) variables as a means of allowing the intercept values to change monthly while holding slopes constant. Additionally, since prices and deliveries are normally negotiated on a weekly basis, a two-equation simultaneous system was estimated using the Two Stage Least Squares (2SLS) method of estimation (16).

Two relationships, demand and supply, were postulated in equations 1 and 2, respectively.

$$\text{(eq. 1) D: } X_1 = a_1 + B_{1,2}X_2 + B_{1,3}X_3 + B_{1,4}X_4 + B_{1,5}X_5 + B_{1,7}X_7 + \ldots + B_{1,17}X_{17} + u_1$$

$$\text{(eq. 2) S: } X_5 = a_5 + B_{2,1}X_1 + B_{2,2}X_2 + B_{2,3}X_3 + B_{2,6}X_6 + B_{2,7}X_7 + \ldots + B_{2,17}X_{17} + u_2$$

Where:

X_1 = USDA nine-city weighted average wholesale price of ready-to-cook broilers (cents/pound).

X_2 = Average price of pork (100 pound wholesale cuts at Chicago) (cents/pound).

X_3 = USDA nine-city weighted average wholesale price of ready-to-cook broilers, lagged two months (cents/pound)

X_4 = Per capita disposable income (thousand dollars).

X_5 = Quantity; chicken certified as wholesome in federally inspected plants, ready-to-cook weight, plus cold storage stocks (million pounds).

X_6 = Average broiler price per pound at farm level (cents/pound).

X_7 = Through X_{17} = Zero-one (dummy) variables (monthly intercept shifters).

a_1 = Price intercept (demand function).

a_2 = Quantity intercept (supply function).

$B_{ij\text{'s}}$ = Parameters (i = 1,2 and j = 1, 2....., 17).

u_1 = Error term (demand function).

u_2 = Error term (supply function).

Statistical Model and Results

The 2SLS procedure is to first olve the reduced form equations.* Thus, the predicted values for broiler price and quantity were obtained in their reduced form. These predicted values were then substituted for the original observations in the supply and demand equations with the following results:

Demand equation:

$$\text{(eq. 3) D: } X_1 = 22.42 + \underset{(.0112)}{\overset{**}{.13X_2}} + \underset{(.0248)}{\overset{*}{.06X_3}} + \underset{(.6127)}{\overset{**}{12.37X_4}} - \underset{(.0037)}{\overset{**}{.08X_5}}$$

$$- \underset{(.3282)}{\overset{*}{2.99X_7}} \text{ or February} + \underset{(.2654)}{\overset{**}{.70X_8}} \text{ or March} + \underset{(.2713)}{.43X_9} \text{ or April} + \underset{(.2874)}{\overset{**}{3.25X_{10}}}$$

$$\text{or May} + \underset{(.3305)}{\overset{**}{4.94X_{11}}} \text{ or June} + \underset{(.2825)}{\overset{**}{3.32X_{12}}} \text{ or July} + \underset{(.3512)}{\overset{**}{4.66X_{13}}} \text{ or August}$$

$$+ \underset{(.2860)}{\overset{**}{1.36X_{14}}} \text{ or September} + \underset{(.3061)}{\overset{**}{1.41X_{15}}} \text{ or October} - \underset{(.3308)}{\overset{**}{5.67X_{16}}} \text{ or November}$$

$$- \underset{(.2872)}{\overset{**}{4.51X_{17}}} \text{ or December}$$

R^2 = .93 Std. error of estimate = .52

Supply equation:

$$\text{(eq. 4) S: } X_5 = 280.52 + \underset{(3.684)}{\overset{**}{73.47X_1}} + \underset{(.561)}{\overset{**}{2.57X_2}} - \underset{(1.177)}{1.80X_3} - \underset{(4.526)}{\overset{**}{126.26X_6}}$$

$$- \underset{(12.194)}{\overset{**}{37.33X_7}} + \underset{(12.239)}{14.39X_8} + \underset{(12.356)}{16.56X_9} + \underset{(12.084)}{\overset{*}{30.77X_{10}}} + \underset{(12.227)}{\overset{**}{35.07X_{11}}}$$

$$+ \underset{(12.539)}{\overset{*}{26.59X_{12}}} + \underset{(12.273)}{\overset{**}{62.65X_{13}}} + \underset{(12.542)}{4.29X_{14}} + \underset{(12.723)}{\overset{**}{35.21X_{15}}}$$

$$- \underset{(12.632)}{\overset{**}{51.31X_{16}}} \quad \underset{(12.928)}{\overset{**}{46.08X_{17}}}$$

R^2 = .94 Std. error of estimate 23.85

Where:

= significant at the 95 percent level

** = significant at the 99 percent level

( ) = standard errors of the respective coefficients

**Reduced form is the solution of each endogenous variable as a function of all exogenous variables in the ystem.*

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